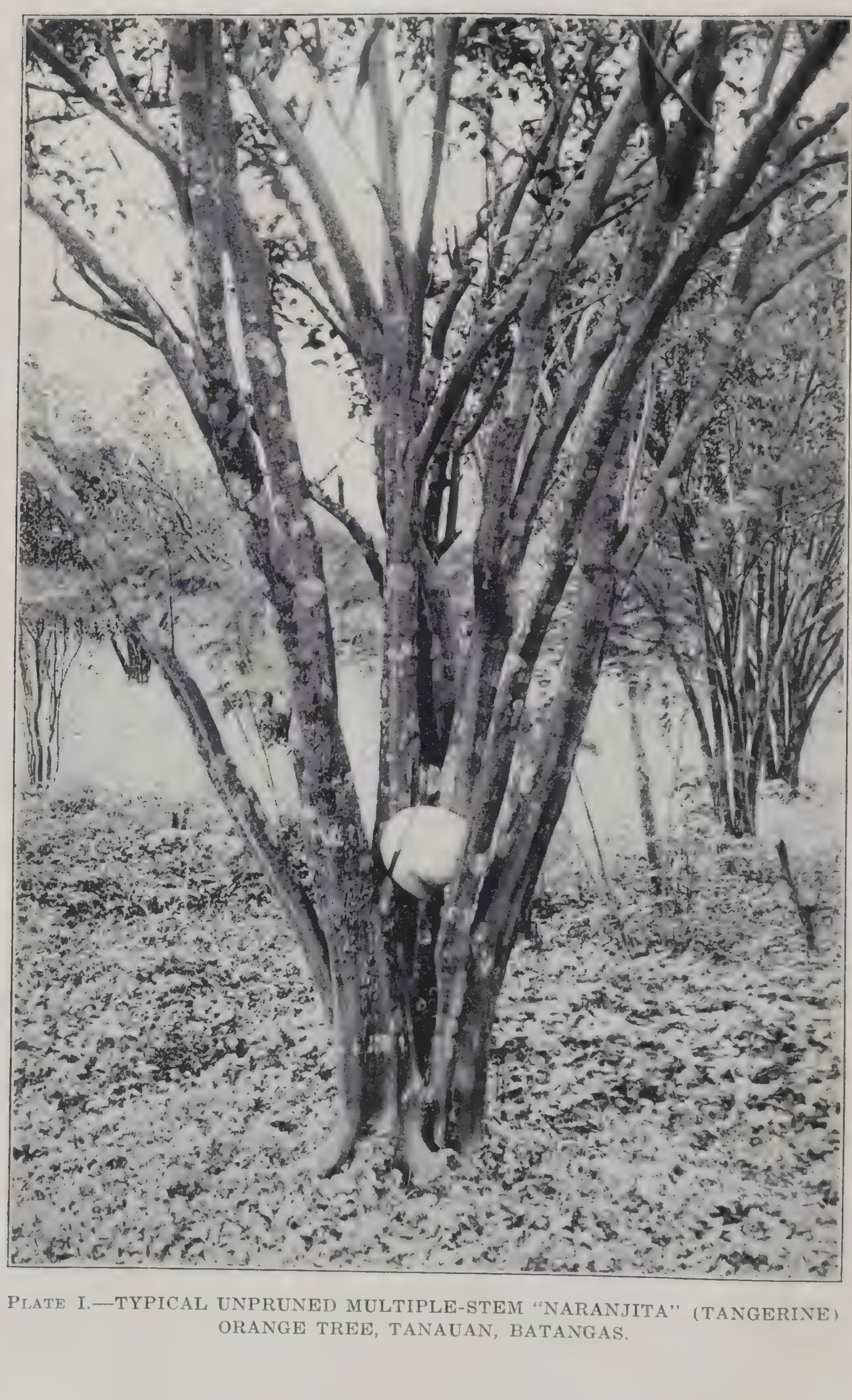

PLATE I.—TYPICAL UNPRUNED MULTIPLE-STEM "NARANJITA" (TANGERINE) ORANGE TREE, TANAUAN, BATANGAS.

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CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

COOPERATION.

By the DIRECTOR OF AGRICULTURE.

One who has given any study, even in a very superficial way, to the agricultural conditions in the Philippines, must gain the impression at the very start that no considerable amount of results can be secured in bettering the conditions of the Islands without intelligent and efficient coöperation between the Bureau of Agriculture and the growers of the various crops, from the sale of which must come for many years the money resources of the people.

The Bureau of Agriculture might be organized in a most effective way, with thoroughly practical men in every division, able to render most efficient help in the way of information and advice, and yet, if the people who actually grow the crops do not avail themselves of the opportunity to get this help, the whole organization is practically without value. As the conditions now are in the Islands, large sums of money for carrying on work in

any Bureau not being available, no other way seems possible for rendering efficient aid except by coöperation. The way in which this may be brought about is very simple in theory, but how well it can be worked out in practice depends entirely upon the people for whom the Bureau and all its branches are organized.

The matter of bringing about such coöperative demonstration work is one of the most important facing the Bureau at this time. How this may be done may be illustrated very thoroughly by speaking of one line of work which has been started and promises to be very useful. Reference is made to the tobacco work being done by the Bureau in the Cagayan Valley. This work, which has recently been started, is to be continued along the following lines:

A small station is maintained at Ilagan in Isabela Province. It is not the intention to carry on at Ilagan any large or expensive line of activities, but it will be used as a center from which to work among all those tobacco planters who desire to coöperate. At the station will be grown tobacco of various varieties and under varying conditions, and an attempt will be made to illustrate proper methods of cleaning seeds, curing and packing tobacco, and all other practical questions which come up to the planter. By far the larger and more important work, however, will be through asking tobacco growers to coöperate with the station by planting small plats under such conditions and of such varieties as are recommended by the Bureau, with a further agreement that the cultivation, gathering, curing, and packing of tobacco from these tracts shall be done with the help and assistance, in an advisory way, of the Bureau. There is no doubt that within a very short time the value of the tobacco produced in the valley may be increased very largely in proportion to the area planted.

If intelligent and effective coöperation like this is carried on in the same way, there is no reason why assistance may not be given by the Bureau in the growing of rice, sugar, rubber. coconuts, fruits, vegetables, and in fact all the agricultural products either now grown in the Islands or which may be successfully introduced.

A few dozen coöperative demonstrations—such as has been described in the case of tobacco—applied to all of the other crops mentioned, as well as to any others which can be grown here, would, in a very short time, show the varieties of soil-products which are adapted to the different localities and greatly increase the actual amount received from the sale of the various crops. In the case of rice, the Bureau has growing nearly a

thousand varieties of the grain from which are being selected those kinds best adapted to the manifold conditions, and in another year the Bureau will have seeds of these selected varieties for distribution to those growers who will agree to carry out coöperative demonstration work, enabling the Bureau to learn what kinds are adapted to the different localities and to point to the results which have been reached under conditions which can be met by any grower.

The Bureau is extremely anxious to get in touch, as rapidly as possible, with all those growers of crops anywhere in the Islands who are willing to coöperate in any way. Applicants for an opportunity to carry on such work should designate the crops which it is believed will succeed in the neighborhood, how much land is available, what soil-products are now successfully grown, and such other information as will enable the Bureau to select the varieties it believes would succeed in the district.

There are doubtless, in many parts of the Islands, varieties of crops which have been introduced or which may have originated in particular sections that are so much better than the average that they could well be introduced more widely in the same neighborhood and tried in other places where the probabilities indicate that they would succeed. The Bureau is desirous of knowing of all such cases as this and of receiving seeds or plants with which it may experiment.

Such coöperative demonstration work can be carried on most effectively and helpfully when the location is such that the fields may be visited and studied by as many interested people as possible. They should, except under special circumstances, be located near centers of population so their effect may be made as broad as possible through a knowledge of the results coming to many people in the immediate neighborhood. The Bureau is earnestly desirous of bringing about a large amount of such coöperative work and will particularly welcome helpful suggestions and requests from those who are sufficiently interested to join in such an arrangement.

REPORT OF THE DIRECTOR OF AGRICULTURE FOR THE FISCAL YEAR ENDING JUNE 30, 1911.

CONTENTS.

DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE,
Manila, August 1, 1911.

SIR: I have the honor to submit herewith the Tenth Annual Report of the Director of Agriculture for the Philippine Islands. This report covers the period from July 1, 1910, to June 30, 1911.

GENERAL STATEMENT.

The year just concluded has been marked by developments of more than usual significance, not only to the Bureau of Agriculture but also to the entire agricultural interests of these Islands. The long period of industrial depression, brought on by war, drought, cholera, rinderpest, and the locust pest, from which the Philippine Islands have suffered for more than a decade, appears to be giving way to a period of development and prosperity. Improved agricultural conditions are to be noted throughout the greater part of the Archipelago. The sugar industry, stimulated by the removal of the duty on Philippine sugar imported into the United States to an amount considerably larger than our present total exports, is coming into rapidly increasing prominence and is beginning to receive the serious attention of both local and foreign capitalists. The high price of copra, which promises to be permanent, has brought prosperity to all of the coconut-growing sections, and the area planted to coconuts is being largely increased. Abacá, the export product of first importance, continues to suffer from low prices. The indica-

tions, are however, that there will be no further decline; improvement in the quality of fiber by the introduction of fiber-cleaning machines, and more careful methods of preparation, should, in a measure at least, restore this industry to its flourishing condition of earlier years. Tobacco has suffered from a lessened demand in the United States for Philippine tobacco, due to factors which do not require detailed discussion. The most promising feature of the tobacco industry at present is the increased interest shown by the growers in the production of a better quality of tobacco. When such improvement becomes more general there will be a correspondingly increased demand at better prices for Philippine tobacco.

The damage done by locusts during the year has been comparatively small, and the active measures taken for the extermination of this pest are already beginning to show results. Animal diseases, principally rinderpest and surra, continue to be the one great blot on what is otherwise a most encouraging agricultural situation. The heroic efforts that are being made to bring under control and eventually eradicate these diseases from the Philippine Islands are discussed in detail in this report. In November, 1905, the veterinary corps of the Bureau of Health was transferred to the Bureau of Agriculture. From that date to the present time the work of the Bureau of Agriculture has, of necessity, been largely defensive rather than constructive. Inasmuch as dangerous epizoötic animal diseases, which have threatened the very existence of our agriculture, have been widespread throughout the Archipelago, the control of these diseases has been considered the work of first importance. With but limited funds available, it has been necessary to neglect in a large measure other important lines of work. As a result of this policy the Bureau has been subjected to the severest criticism, from which it will continue to suffer until such time as it may become possible to carry on in a larger measure the constructive work for which there is such urgent demand.

During the past year the work of the Bureau has been reorganized, and it is now established on a broad basis that will admit of such future development as available funds will permit. The staff has been materially strengthened, and considerable in the way of direct results has already been accomplished. While it is essential both to the present and the future prosperity of the Islands that there should be no lessening of the activity in the work of disease eradication, it is of only secondary importance that provision be made for developing the constructive work of the Bureau. The only solid foundation for the

improvement of industrial conditions in the Philippine Islands is agricultural prosperity. It is believed, therefore, that every effort should be made to promote the development of our agricultural resources, and that the Bureau of Agriculture should receive in the future an even larger measure of support than it has received in the past.

ORGANIZATION.

On July 1, 1910, the work of the Bureau of Agriculture was reorganized, with a view of promoting increased efficiency under existing conditions and of providing for future development. Under the new organization 10 divisions were created, 4 of which were placed under the administrative supervision of the Director, 3 under the Assistant Director, and 3 under the Assistant to the Director, as follows:

DIRECTOR.

Clerical, finances and property, veterinary, animal husbandry.

ASSISTANT DIRECTOR.

Plant industry, experiment stations, machinery and building.

ASSISTANT TO THE DIRECTOR.

Agricultural extension work, publications, statistics.

This organization has been found satisfactory and will be continued.

PERSONNEL.

The following have been the more important changes in the personnel of the Bureau during the year: Chief veterinarian, appointed July 3, 1910; pathologist, appointed July 25, 1910; veterinary entomologist, appointed September 8, 1910; superintendent of experiment stations, appointed October 15, 1910; tobacco specialist, appointed September 1, 1910; horticulturist, appointed March 14, 1911; fiber expert, appointed August 6, 1910.

Thirty-six Americans have been appointed to classified positions, and 14 have been separated by resignation and transfer—a net increase of 22. Seven Filipinos have been appointed to classified positions, and 3 have been separated by resignation and transfer—a net increase of 4.

The number of temporary employees appointed and separated during the year has far exceeded that of previous years, this being due principally to the large increase in veterinary field work.

VETERINARY DIVISION.

The most important event in this division during the fiscal year was the arrival from the United States on July 2, 1910, of Dr. A. R. Ward, chief veterinarian. His appointment was made during the last fiscal year but he was unable to sever his connection with the University of California and report here for duty until after the beginning of this year. As soon as he reported for duty he was given entire charge of the veterinary division and Dr. F. C. Gearhart, who had been acting chief veterinarian for more than two years, was relieved and appointed chief of the division of animal husbandry. Dr. R. F. Knight, one of the district veterinarians, was appointed assistant chief veterinarian to take active charge of the office work of the division.

Doctor Ward began a systematic research of the literature on rinderpest, pleuro-pneumonia, and other diseases, the suppression and control of which are the principal work of this division; he also planned and began systematic laboratory experiments with a view of determining some of the technical questions and obscure points in the nature and control of these diseases. These lines of work consumed the most of his time during the first six or eight months of the year and left him but little opportunity to look after the field work of the division. The district and provincial veterinarians continued to follow the methods previously used with such modifications, from time to time, as Doctor Ward saw fit to put into force. After the discontinuance of the use of serum, Dr. C. G. Thomson, formerly superintendent of the serum laboratory at Alabang, was relieved from duty there and given charge of the important field work. Before the close of this fiscal year he was given supervision of the field forces and is traveling extensively in the general oversight of the work and reorganization of the provincial forces, along lines necessitated by the changes in the plans of the field work.

The efforts of this division have been concentrated very largely on the suppression of rinderpest, which has shown a tendency to spread extensively during the year, especially in central Luzon, from Lingayen Gulf south to Manila, in the Islands of Leyte, Cebu, Siquijor, and in the Provinces of Oriental Negros, Surigao, Cagayan, and Isabela; the total number of municipalities infected at the close of the year was 81 as compared with 25 reported at the close of the previous year. The number of deaths from the disease and the corresponding interference with agricultural work and transportation in the provinces were correspondingly greater than during the previous year.

Doctor Ward has introduced into the work of the division a number of new features, principal among which are: The abandonment of the use of anti-rinderpest serum; the concentration of the efforts of the entire force on rinderpest alone in limited sections of the Islands, with a view to the entire suppression of the disease there before undertaking work in other territory; the advocacy of the extensive use of fencing as a quarantine measure against the movements of infected animals; there was also introduced into the work in Pampanga, Bulacan, and Cavite Provinces, a system of "voluntary coöperation" by the officials and people of the municipalities where the disease existed. This latter plan was advocated by the Executive Secretary and in carrying it out the veterinarians act simply in an advisory professional capacity when their assistance is called into requisition by the people of the community.

During the year much more extensive use of the police power has been made than ever before, the forces being drawn from local Constabulary companies and Philippine Scouts detailed on special duty with the Bureau of Agriculture. There was also a considerable increase in the number of employees engaged in the veterinary work and correspondingly in the expenditures.

The efforts of this Bureau to secure an adequate appropriation to be used in the condemnation and slaughter of infected animals were again unsuccessful, but His Excellency the Governor-General authorized the expenditure of a small sum in this direction in order to test the merits of this plan. The entire suspension of the shipment of live cattle from Hongkong was finally accomplished during this year, as they continued to bring disease as long as they were permitted to be landed under any conditions. Cattle and carabaos imported from Indo-China continued to arrive in excellent condition until about the close of the year when an extensive outbreak of foot-and-mouth disease appeared among the animals of one importation from which it spread to several provinces. Special arrangements were perfected by importers for the construction of temporary stockyards at Sisiman Bay on the military reservation and orders issued permitting the importation of Australian cattle for slaughter from the Wyndham District, from which place pleuro-pneumonia was imported about the close of the last fiscal year.

In the concentration of the efforts of this division on the work with rinderpest, the suppression of surra has been largely abandoned, though there does not appear to be any extensive spread of this disease.

On June 13, 1911, His Excellency the Governor-General

directed that the entire supervision of the veterinary division be vested in Doctor Ward, who should report direct to the Secretary of Public Instruction and the Governor-General on matters pertaining to this division. As he had enjoyed the same authority under the Director of Agriculture during that portion of the year prior to this date, the body of his report is quoted as follows:

PERSONNEL.

At the beginning of the fiscal year 1911 there were on duty 41 veterinarians, 6 American live-stock inspectors, and 56 Filipino live-stock inspectors. On June 30, 1911, there were 47 veterinarians, 1 veterinary pathologist, 1 veterinary entomologist, 56 American live-stock inspectors, and approximately 300 Filipino live-stock inspectors. During the year 3 veterinarians resigned from the service and 8 were granted leave for the purpose of visiting the United States. There were 7 veterinarians appointed during the fiscal year 1911, not including the pathologist and entomologist.

FIELD WORK.

During the past year circumstances have indicated the desirability of concentrating the efforts of the division upon rinderpest to even a greater degree than in previous years.

Rinderpest.—At the beginning of the year the most serious problem arising was that concerning the results that were being obtained by the use of anti-rinderpest serum. An exhaustive series of investigations led to the conclusion that under conditions existing in the Philippines equally good results might be obtained by other methods and its use was discontinued. It is interesting to note that, after the conclusion of the experiments, it was discovered that similar experimental work had been carried on in India with conclusions confirming those of this Bureau, so far as the work was duplicated.

Following the discontinuance of the use of serum, the effort to control rinderpest was centered upon the object of keeping animals separated from one another and upon detecting the diseased animals, so that they might be placed under restraint in corrals. These requirements necessitated greater concentration of employees in order to accomplish the desired results. When veterinarians and their assistants available for this work are somewhat uniformly scattered throughout a known infected territory, experience has shown that they are ineffective, because each group is coping with an impossible task. A few municipalities in a province might be successfully ridden of disease,

but while this is being done others are being neglected, and when attention is drawn to the others, the first municipalities that were cleaned up might again become infected. Isolated examples of disease eradication like this are not permanent and do not contribute to the final restriction of the territory harboring rinderpest. A year of such work will show a gratifying number of municipalities where the disease has been eradicated, but a consideration of the total number infected at the beginning of the year and at the end of the year may show no progress. The gain resulting from such work is merely the lessening of the losses in the community involved, without permanent eradication.

With scattered forces, the losses from rinderpest may be minimized, but under such conditions the actual amount of territory containing infected animals cannot be reduced. The work during the year has been of two classes: First, scattered effort as described, covering about eight months; secondly, the marked concentration of effort in a few localities looking to the discovery of the last case of rinderpest in that territory and the consequent eradication of the disease.

Concentration affords an opportunity to standardize methods and closely supervise the work of employees. This leads to a better knowledge of the individual qualifications of men and adds to our knowledge of the results following a given system of procedure. When men are scattered, supervision is difficult and so many individual methods of conducting the work spring up that the central office cannot draw valuable conclusions from field experiences. A valuable feature of concentration lies in the fact that it affords means of obtaining information as to the actual amount of disease prevalent, which cannot be obtained without a large number of employees in a given area. The ultimate goal of concentrated effort is the extinction of rinderpest in the area involved, followed by similar effort in contiguous areas with the aim of ultimately covering the whole of the infected area.

The year has witnessed the abandonment of the idea that municipal police are effective or available in numbers enough to constitute an important feature in controlling the movement of animals, which requirement is of prime importance in the campaign in progress.

Constabulary have been utilized to a greater extent than formerly and are extensively employed throughout the Islands, except in those places where the most concentrated effort is being employed. The Bureau of Constabulary has most generously and willingly contributed aid up to the very limit of the facilities available.

The concentration of effort against rinderpest in Pangasinan and Occidental Negros was made possible only through the broad-minded public spirit shown by the Commanding General, Philippines Division, in assigning some 1,200 Scouts, 41 cavalrymen, and 5 veterinarians for duty with the Bureau of Agriculture. The officers, enlisted men, and veterinarians have made the cause of the Bureau of Agriculture their own. They have worked with an enthusiasm and esprit de corps that augurs for success. The number of Scouts available has been limited only by the number of available employees of the Bureau of Agriculture necessary to utilize Scouts advantageously.

The importance of the animal-industry interests of Pangasinan and other considerations indicated the desirability of beginning there the quarantine work with Scouts. As a preliminary, a training school in charge of a veterinarian was instituted for the purpose of instructing live-stock inspectors and soldiers in the recognition of rinderpest and fundamental sanitary principles underlying the work. This was conducted by means of informal talks and demonstrations with sick animals as subjects. The Scouts are used as patrols with the double duty of preventing the unauthorized movement of animals and of detecting animals suspected of being infected with rinderpest.

The problem of combating rinderpest is quite different from the popular notion. So far as known at present there is only one area where rinderpest is causing serious losses. In the greater portion of the infected area, the disease is very scarce and mild in character, but sufficient to keep alive infection. In many places where the disease has existed for a long time the greater portion of the animals, the older ones, are immune to the disease, the losses occurring among younger animals. This situation is serious enough in itself because it constitutes a steady drain on the animal resources and is an obstacle to the accumulation of a proper and desirable number of cattle and carabaos. The greater menace in such a situation lies in the fact that disease infection is kept smoldering in spots to cause extensive losses when introduced into districts that have been free for years and have become heavily stocked with susceptible animals. For instance, during the outbreak at Davao 100 per cent of those attacked died, while it is doubtful if 50 per cent died in Pangasinan. When losses are not great, the disease is not at all alarming to stock owners in general nor to officials. The detection of cases of rinderpest under such circumstances is a task which must be accomplished by scouts and representatives of the Bureau of Agriculture. It calls for the most thorough work for the

detection of the last suspicious case, for thorough organization and painstaking work.

As a preliminary, a census of animals as required under Executive Order No. 24 is obtained from the municipal president. With this as a basis an independent census of the animals in each barrio is made and this is always a larger list than that furnished by the president, for by no means all the animals are registered that should be. With this census as a basis the animals in infected barrios are scrutinized for a sufficient length of time to insure that they are free from disease. The results that are being obtained where the forces are concentrated are entirely satisfactory.

Slaughter has been employed in a tentative and experimental way. When first instituted it was thought that the offer to pay for sick animals would encourage owners to bring them to the attention of the veterinarians. In several places it was noted that stock owners would hesitate about reporting cases because such reporting resulted in their other animals being placed in quarantine, which was regarded as offsetting the advantage of having pay for the sick animals. For instance, in one province, animals were seldom reported until on the verge of death and then not until every other animal in the barrio had been taken elsewhere to avoid quarantine. Such a result naturally rather encouraged the spread of disease than otherwise.

From experiments conducted at Alabang for the purpose of determining when an animal suffering from rinderpest is infective to other animals, the fact developed that cases cease to be dangerous to other animals shortly after diagnostic symptoms are fully developed and that animals in the very earliest stages also spread disease. Under conditions obtaining in the Philippines it is difficult to determine what other animals have really been in contact with the sick ones. Hence, slaughter can not include exposed animals and thus is not the thorough measure that it should be and is when employed in fenced countries.

Owing to the difference in the methods employed for detecting and reporting disease at the beginning and end of the fiscal year, it is impossible to present figures that would mean anything in relation to the gain or loss in the number of infected municipalities or provinces.

Contagious pleuro-pneumonia.—Shortly before the beginning of the fiscal year reported upon, extensive importations of live cattle from northern Australia occurred. These cattle were extensively distributed throughout Luzon. The discovery of con-

tagious pleuro-pneumonia among these animals at the matadero in Manila was a circumstance that called for prompt measures to avert its gaining a permanent foothold in the Philippines. A general order was immediately issued to provide for the slaughter under strict precautions in Manila of animals en route and to prevent further importations. Fortunately animals that had gone to the provinces were destined for slaughter. There was comparatively little difficulty in regard to these. Both in Manila and in the provinces there were a large number of cattle and carabaos that had been exposed to Australian animals and all of these were located and quarantined for four months when not intended for slaughter. In the course of the work, two native animals were found on slaughter to have contracted contagious pleuro-pneumonia. No evidences are at hand to indicate that the disease has become permanently introduced in the Islands.

The interdiction against the importation of Australian cattle affected dairy cattle as well as beef animals, and constituted a vexatious addition to the many obstacles in the way of supplying fresh milk to Manila. The character of Australian beef and its price made it a matter of regret that any conditions should render it necessary to stop the importations.

These conditions indicated the desirability of the most searching investigation of the animal disease conditions in Australia. Accordingly, Dr. F. C. Gearhart sailed on July 30, 1910, for Australia, with instructions to determine the possibility of obtaining healthy Australian dairy cows and cattle for immediate slaughter and to determine to what extent the Australian Government could coöperate in this matter. Doctor Gearhart spent several months in Australia, Tasmania, and New Zealand. On his return he prepared an admirable report on the animal disease situation in those countries. Reduced to the shortest possible statement his report showed that nowhere in Australia could there be obtained beef cattle absolutely free from contagious pleuro-pneumonia. Dairy and breeding stock could be safely imported under very strict precautions exercised with the assistance of the officials of the department of trade and customs of the Commonwealth of Australia. From Doctor Gearhart's report it was concluded that if Australian beef cattle were to be imported for slaughter that this might be done under conditions reducing to a minimum the danger of infection of local cattle to contagious pleuro-pneumonia. Accordingly, at the end of the period reported upon, arrangements are being made for the slaughter of Australian cattle in an isolated spot at Sisiman

Bay. Likewise dairy and breeding stock may be imported when accompanied by a certificate showing that they have come from a district free from that disease.

Surra.—This disease has been found in nearly all provinces of the Islands at some time during the past year. The infection is apparently widely disseminated but as cattle and carabaos show a great resistance to this disease no great loss is caused from it, unless it becomes prevalent in a district where there are a large number of horses. It spreads rapidly from one horse to another when these animals are running in large droves. Its spread in localities where the horses are stabled separately, or in small groups, has not been rapid.

Foot-and-mouth disease.—At the beginning of the fiscal year about 60 animals were infected by this disease and held in quarantine in one of the corrals in the city of Manila. During the months of July and August these animals were slaughtered at the matadero of Manila. During the months of September and October, foot-and-mouth disease was found in cattle imported from Hongkong, which were being detained on lighters in Manila Bay, but the infection was confined to the animals on the lighters, and no epizoötic resulted from these importations.

In the month of June, the steamer *Spir* brought cattle and carabaos from Pnum Penh to Manila and Iloilo. These animals were infected with foot-and-mouth disease which was not discovered until after the animals had been landed. The importation of this infected shipment resulted in the infection of several provinces, but the measures taken to control the disease have, up to the present time, given favorable results. Subsequent shipments from Pnum Penh arrived infected with foot-and-mouth disease, but as the corrals in Manila were already infected, little harm could be done by the addition of a few more animals, and accordingly special provisions were made for the landing of all animals embarking from Pnum Penh prior to June 21.

Glanders.—A few cases of glanders have been discovered during the year. The majority of these cases have been found in the city of Manila, but a case or two is occasionally found in the provinces. This disease has not spread from one animal to another rapidly enough to be alarming.

Anthrax.—A few cases of anthrax have been found in the municipality of Taytay, Rizal Province, but this disease has not been discovered in any other locality in the Philippines during the year.

Rabies.—A very few cases of rabies were discovered in the

city of Manila. This disease has not been found or reported in the provinces.

Hemorrhagic septicemia.—There have been a few cases of hemorrhagic septicemia, the majority of which were discovered in the Province of Zambales. This disease has been confined almost entirely to the carabaos and has not caused any extensive losses.

The total reported deaths recorded from various diseases were 6,032 carabaos, 3,543 cattle, and 1,293 horses. For all practical purposes, the total deaths among cattle and carabaos may be attributed to rinderpest and those among horses, to surra. The occurrence of various diseases by provinces shows that rinderpest attacked 2,733 animals in Pangasinan, 867 in Leyte, 573 in Pampanga, 572 in Zambales, 450 in Bulacan, 410 in Surigao, 377 in Oriental Negros, with a total of 8,438 in all of the provinces.

RESEARCH WORK.

Minor alterations in the plant of the serum laboratory at Alabang adapted the buildings and sheds to accommodate research work. During the year extensive experimental work has been carried on and as a result scientific papers on the following topics are ready for publication:

Experiments on the Efficiency of Anti-rinderpest Serum. By A. R. Ward, C. G. Thomson and F. W. Wood.

Experiments upon the Transmission of Rinderpest. By A. R. Ward and F. W. Wood.

Notes on the Muscular Changes Brought about by the Inter-muscular Injection of Calves with the Virus of Contagious Pleuro-pneumonia. By W. H. Boynton.

A Note upon Strangles in the Philippine Islands. By W. H. Boynton.

A Note upon Anthrax in the Philippine Islands. By W. H. Boynton.

Experiments in the Transmission of Trypanosomiasis. By M. B. Mitzmain.

Notes on the Role of Carabao Lice in the Transmission of *Trypanosoma evansi.* By M. B. Mitzmain.

During the year research has been carried on in connection with a number of other topics, but progress is not sufficient to warrant publication as yet. Among the problems investigated are the filtration of rinderpest virus in blood and peritoneal fluid, pathology of intestinal lesions of rinderpest, normal cellular composition of blood of carabaos, abnormal changes in rinderpest, verminous bronchitis in carabaos, osteoporosis in the horse, blood changes in epizoötic lymphangitis and the insect parasites of horses, cattle, and carabaos.

The work carried on has been dictated by the need for information in connection with field work, and the results have been immediately applied to such work with great benefit.

During a portion of the year the pathologist enjoyed the privileges of the Bureau of Science, where every courtesy and needed assistance was generously accorded him. The veterinary entomologist was quartered during most of the year at the San Lazaro immunizing station.

QUARANTINE SERVICE.

Quarantine service has been maintained during the year at Manila, Iloilo, and Cebu, but in the latter city no quarantine station has been available. Early in the fiscal year the construction of the Pandacan quarantine station had progressed to such an extent that it was possible to begin using it for quarantining live stock. Its incompleted condition left much to be desired, but, nevertheless, it offered better facilities for controlling disease than that offered by the corrals owned by the various dealers scattered throughout the city.

Importations from Australia were permissible only during seventeen days of the fiscal year. During the first five months, cattle from China were allowed to be imported with the restriction that all animals be held for ten days' quarantine after arrival, upon lighters in the bay. Both rinderpest and foot-and-mouth disease appeared among these animals and there was great danger of these diseases being carried ashore by the attendants. Consequently, a general order was issued imposing a three months' quarantine on all such cattle, which had the effect of prohibiting importation. Thus, the importation of cattle has been restricted to animals from Indo-China. At the very close of the fiscal year foot-and-mouth disease was discovered among shipments of cattle from Pnum Penh, Indo-China, and further shipments were discontinued until such time as that port shall be considered free from foot-and-mouth disease.

Stock yards and mataderos are being constructed at Sisiman for the reception of Australian beef cattle imported for immediate slaughter.

Manila.—During the year 112,397 head of live stock have been inspected on arrival by sea, of which 46,501 were imported, 65,896 domestic, and 21,018 were inspected before shipment to the provinces.

Cebu.—During the year 2,064 animals were inspected upon arrival by sea, of which 938 were removed from the city after inspection.

Iloilo.—During the year 16,935 head of live stock were inspected upon arrival by sea, of which 8,806 were removed from the city after inspection.

MEAT INSPECTION.

During the year 93,790 animals were inspected post-mortem at the Manila matadero, of which 712 carcasses and 48,052 parts were condemned post-mortem.

ANIMAL HUSBANDRY.

The division of animal husbandry was created on July 1, 1910. Dr. F. C. Gearhart, formerly acting chief veterinarian, was appointed the chief of this division. He was detailed on investigational work in Australia from July 31, 1910, to January 10, 1911, during which time Mr. C. W. Edwards was acting chief of the division. Due to the absence of Doctor Gearhart in Australia, and the great amount of routine work which has required his attention since his return, much of the work contemplated and planned for this division has not yet been completed. The work of the division of animal husbandry includes the supervision of Bureau stock farms, public breeding work in the provinces, the purchase and sale of live stock, and animal feeding tests and breeding experiments.

BUREAU STOCK FARMS.

There have been maintained during the year three stock farms, at Alabang, in Rizal Province, at Trinidad, in the subprovince of Benguet, and at La Carlota, in Occidental Negros. The first and last named are not exclusively stock farms, but are also used as plant experiment stations.

Alabang stock farm.—Much of the work on this farm during the year has been the improvement of the roads, buildings and irrigation system, and the raising of forage for the maintenance of the farm animals and the animals of the pathological laboratory. The production of forage crops, principally Guinea grass and sorghum, has been very satisfactory, and the cost of maintaining the live stock on this farm has thereby been greatly reduced. Only a small part of the imported feed usually furnished from Manila has been supplied during the year. With the exception of the Maltese and Spanish goats, all of the live stock has done much better than during former years. The stock at the Alabang farm is now in better condition than at any time since this farm was established.

There were sold during the year from this farm animals to the value of ₱9,686.14 as follows: Six horses, ₱1,697; 28 head of cattle, ₱1,006; 42 Berkshire pigs, ₱1,134; 128 rabbits and 1,716 guinea pigs ₱5,849.14.

At the end of the year there were on this farm 58 horses, 4 mules, 246 head of cattle, 35 swine and 40 goats.

Trinidad stock farm.—The cattle at this farm have continued to thrive in a very satisfactory manner and the herd has been maintained at a very small expense, no grain being fed except to the breeding bulls; the horses have done as well as usual, except for a small outbreak of osteoporosis, which affected about a dozen head.

Because of the limited amount of available pasture, the rugged nature of much of the grazing grounds, the cold rains, the impossibility of producing forage and the great cost of transporting feed from Manila, this farm has always been very unsatisfactory for the production of horses. There are no compensating advantages in producing horses on this farm, while the disadvantages are very apparent. It is believed that horse breeding should be discontinued at Trinidad, and that the horses now there should be removed, either to a new farm within easy reach of Manila or to Alabang and La Carlota.

During the year 19 cattle, 3 horses, 8 goats, and 7 sheep were sold from this farm, the total amount received for this stock being ₱2,475.

La Granja Modelo.—At the beginning of the year there were on this farm 19 American mares, 1 Morgan stallion, and 1 mestizo stallion. During the year there were transferred to this farm from other stations of the Bureau, 43 head of mares and colts, and 3 native stallions; 6 mares and 6 colts were lost by death.

A part of the Nellore cows have continued in very good condition during the year and the balance in fair condition; the bull is in prime condition; they have subsisted entirely on pasture. The herd of small Chinese cows have kept in excellent condition throughout the year and have dropped 21 grade calves, all vigorous.

The condition of the animals on this farm has been in general quite satisfactory, and the cost of maintenance per head has been less than at the other two stations. A large percentage of the American mares did not produce foals, and as they have been bred regularly and are not now pregnant, it appears that they are barren.

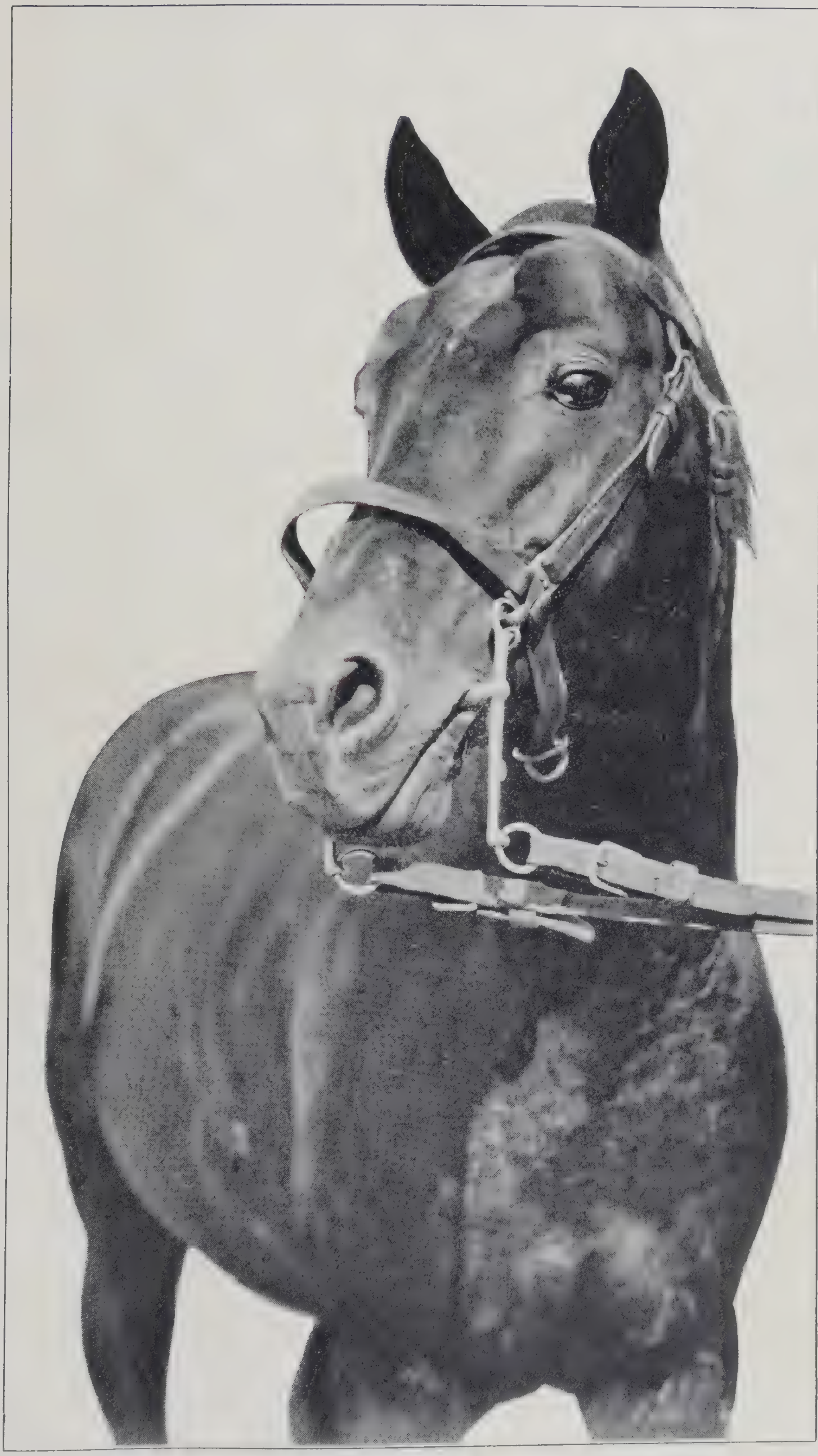

PLATE II.—IMPORTED ARABIAN STALLION "HATIM."

Property of the Bureau of Agriculture. Sire of many of the colts now owned by the Bureau.

BREEDING WORK AT BUREAU FARMS.

The production of good breeding animals for the use of the general public is the chief object and consideration in maintaining and operating the stock farms. The uncertainty, inconvenience and expense incident to importing breeding animals is very great. The desirability, therefore, of producing such animals in this country is apparent. The Bureau of Agriculture is now raising on its stock farms, and distributing to the public, horses, cattle, carabaos, milch goats, and swine.

Horses.—In producing horses to improve the native pony, the defects and excellence of both the native breed and the foreign breeds must be borne in mind. Considering the conditions under which most horses must be kept in these Islands, for at least the next decade, and the character of service required of them, the native breed as a whole can only be said to be inferior to the other breeds in size. They have certain defects, but are enough superior in quality of limbs, constitution, endurance, and adaptability to adverse conditions to more than compensate for these defects. The object, therefore, of the breeding work has been, primarily, to increase the size, and secondly, to improve the defects in conformation without sacrificing the good qualities of the native pony. The ideal method of doing this is by the careful selection, breeding, and feeding of the individuals of the native breed, without the introduction of outside blood. This method will require considerable time, and the demand for immediate improvement is so great that it has been considered advisable to introduce foreign blood. The Arabian breed has been selected as being the most satisfactory for this purpose. This breed has in the past formed the foundation of nearly, if not all, large, light horse breeds; it is the oldest breed in existence, and for this reason individuals of this blood breed truer to type, when crossed on other breeds, than do horses of American and European breeds. It is quite certain that the native pony of these Islands carries a strain of Arabian blood, and this fact is a further argument in favor of using pure-breed Arabian sires for crossing. The size of the Arabian is another advantage, as the individuals of this breed are large enough to greatly increase the size of the offspring, and yet not too large to copulate well with the small native mares.

Cattle.—The following lines of cattle breeding are now being carried on: (1) Pure Nellore; (2) Nellore-mestizo cross; (3) Nellore-native cross; (4) pure-bred Angus; (5) Angus-Galloway

and mestizo cross; (6) Galloway-native cross; (7) Hereford-native cross.

The breeding work with pure-bred Nellore cattle is considered to be the most important line of cattle breeding now being done by this Bureau. This breed has given excellent results in many countries, where they have been tried, and gives promise of being an important factor in the up-building of the cattle herds in this country. Being a working breed of large size and acclimatized to the Tropics, there is every reason to believe that they will prove to be ideal cattle for improving the small native animals. Two herds of pure-bred Nellore cattle are maintained, one at Alabang and one at La Carlota. At Alabang the Bureau has a herd of grade cows representing several crosses and breeds. Until recently, an Angus bull has been with this herd, but it has been necessary to replace him with a Nellore bull. An Angus bull will again be placed with the herd as soon as one can be obtained. At La Granja Modelo a herd of native cows, mainly of Chinese blood, is being crossed with the Nellore bull; very good results are expected from this cross. At the Trinidad stock farm the Bureau has two very fine pure-bred Angus cows that are being bred to a pure-bred Angus bull with the view to producing breeding animals to be used by the Bureau. A very fine herd of grade Galloway cows is kept at Trinidad; it has been impossible to obtain a Galloway bull and as the Angus and Galloway breeds are quite similar, an Angus bull is being kept with this herd. A herd of native cows (Spanish blood predominating) is maintained at Alabang; with this herd there is at present a Hereford bull. This line of breeding is largely experimental, as this cross has never been tried in the Islands before.

Milch goats.—The Bureau has two breeds of these useful animals, which should be of great value to the people of these Islands. As yet they are but little appreciated, due largely to the fact that the Filipinos are not, as a rule, milk consumers. Four herds of goats are maintained by the Bureau; one herd is composed of pure-bred and grade Maltese females with a pure-bred Maltese male; one of pure-bred Spanish milk goats and one of native female goats, which are crossed with a pure-bred Spanish male.

Swine.—The production of good breeding pigs is one of the important services being rendered by this Bureau and a great deal of interest has been taken by the people in this line of stock improvement. The demand for good breeding pigs, especially males, has thus far exceeded the supply. Only one breed, Berk-

shire, has been tried. This breed, which has all of the desirable qualities lacking in the native swine, and which is probably the most prepotent breed in existence, has proven to be of exceptional value for improving the native breed. Alabang is the main breeding farm for pigs, though a few are produced at La Carlota.

PUBLIC BREEDING STATIONS.

It is to be hoped that eventually a public breeding station can be maintained in every province. At these stations should be kept stallions, bulls, billies, bucks and boars, the services of which should be available to the public free of charge. This work can only be established gradually, as the necessary breeding males become available, and the provinces render assistance by furnishing the necessary lands and buildings. At present only stallions are furnished by the Bureau for the free use of the public; these are sent out usually three or more together under the charge of an experienced employee, and are moved from one town to another throughout the provinces. The people are evidencing great interest in this work and are presenting their mares for service in a very encouraging manner. The results obtained by the present method of moving horses from town to town are not in all ways satisfactory, and it is important that this method be replaced by permanent breeding stations. The mestizo colts obtained by the people who patronize the stallions are very highly prized by their owners, and when sold, have been bringing from two to three times the price usually paid for native ponies. Three hundred and thirty-seven mares were bred during the year.

PURCHASE AND SALE OF ANIMALS.

The Bureau has during the year selected, purchased, cared for, and shipped all of the live stock required by all branches of the Civil Government, with the exception of animals purchased outside of the Philippine Islands. The purchasing of animals used for experimental work by the veterinary division has been the largest single item. A great amount of time has been spent in the purchasing of horses and ponies because of the difficulty in obtaining satisfactory animals.

The Bureau has sold a great many of its own animals during the year; these consisted of breeding animals raised on the stock farms, completed serum bullocks, and experimental animals for which the Bureau had no further use. The young bulls, pigs and goats were sold direct to the public at fixed prices; all others, when sold to the public, were usually disposed of at public auction.

PLANT INDUSTRY.

The division of plant industry includes all general plant investigations, seed and plant distribution, and entomological investigations. Under the subject of "Plant Investigations" in this report is included work done both in this division and in that of experiment stations.

PLANT INVESTIGATIONS.

CEREALS.

Rice.—The rice work, both at the Alabang stock farm and at the Lamao experiment station, has been continued along practically the same lines as during the last fiscal year. In addition to these main stations a new testing station has been established on the "Luisita Estate" at San Miguel, Tarlac Province. The rice investigations include field tests under varying conditions of all obtainable varieties of both lowland and upland rice, and laboratory study and classification of these varieties. Plat tests were made at Alabang last year of 165 varieties of lowland rice. Four hundred varieties are being tested this year, nearly all of which appear to be distinct. Some 355 varieties of upland rice were planted at Lamao last year. This year 474 varieties, comprising practically all of the upland types, are under cultivation at Lamao. The examination, classification, and tabulation of data pertaining to this large number of varieties involves a large amount of detail work, but the completed results will comprise an exhaustive investigation of the most important staple crop of the Islands.

FORAGE PLANTS.

At the Singalong, Lamao, Trinidad, and La Carlota stations, and at the Alabang and Trinidad stock farms, collections of legumes and grasses, believed to be more or less adapted to Philippine conditions, have been planted with the idea of testing them as forage crops. This work has been under the management of Prof. C. V. Piper, agrostologist of the United States Department of Agriculture. Since this work must extend over one entire season, completed results have not as yet been obtained. Other projects, outside of the Bureau but more or less directly under its management, have been outlined for the testing of forage plants. The estates of the Compañia General de Tabacos de Filipinas at San Miguel, Tarlac Province, and the Roxas estate at Calauan, Batangas Province, have been selected as suitable places for this work. Some of the introduced forage

species have been very successfully grown at the Alabang stock farm and bales of the most promising sort have been put up for the purpose of testing their keeping qualities in storage.

Guinea grass.—Guinea grass has been the principal crop at the Singalong station and has been grown both for forage and for distribution. The area devoted to this crop has been about $2\frac{1}{2}$ hectares and the yield about 115 tons per hectare for the entire year. All of the area planted to Guinea grass has been dug for roots during the year and one-half hectare was dug a second time. It has been noticed that growing even one crop of corn on the land seems to improve it for Guinea grass. One plat that has been in corn continuously for 6 crops was planted to Guinea grass in September. The grass on this plat made a much more thrifty and even growth and had a better color than that grown on land which is kept continuously in grass. Guinea grass is an important crop at the Alabang stock farm and is considered the most valuable forage crop that has been grown at this farm up to the present time. It has been found necessary at Alabang to replant Guinea grass about once every twelve months as if this is not done it becomes gradually shorter and more fibrous until finally it is not worth cutting. This deterioration is not so noticeable, however, where there is an abundance of irrigation. Certain fields of Guinea grass at Alabang which could not be irrigated have continued to grow well during the dry season and while not as good as the irrigated grass are still sufficiently good to warrant the planting of this crop where water is not available. It grows slowly during the dry season but quickly assumes its natural growth when the rains begin. On unirrigated land Guinea grass should be planted at the beginning of the wet season on well-drained land. It will then have sufficient time before the next dry season to acquire a complete root system. At the Trinidad garden Guinea grass grows fairly well during April, May, and June, but very slowly during the rest of the year. It does not appear to be adapted to the cool weather of this high altitude. Two hectares of Guinea grass have been grown at La Granja Modelo for forage rather than experimental purposes. On account of the unusually heavy rainfall this grass has done exceptionally well. Two fields of Guinea grass were fertilized, one receiving sulphate of ammonia and Japanese tankage in equal parts at the rate of 500 kilos per hectare, and the other an equal amount of "chemical sugar fertilizer." The result in both cases was a splendid revival of the grass.

Corn.—Three varieties of corn, including Mexican June and

two native varieties, *Kalapdos* and *Sagueril* from the Island of Siquijor, have been grown at Singalong. The Mexican June corn gives a good yield but the grain is very soft and is subject to the attack of weevils as soon as it is ripe. The *Kalapdos* variety gave a yield of 1,290.3 kilos (50.7 bushels) per hectare. It has a small ear with very hard grain that is not damaged by weevils. The *Sagueril* variety made a yield of 941.6 kilos (37 bushels) of poor corn per hectare on the same land and with the same care that other varieties have had, and was twenty-three days longer in maturing. Throughout the year plats of Mexican June and *Kalapdos* have been grown where they could not be cross-fertilized. The small plats were also planted with the varieties in alternate rows. The "crosses" obtained were very much like the pure Mexican June variety. At Lamao alternate rows of Mexican June corn and a native variety were planted in November. The rows of Mexican June were detasseled. The yield of the cross-bred rows was fair and many of the ears showed the flinty character of the native variety. Ten of the best ears were selected and planted separately for further selection. The object of this work is to get corn with the good bearing qualities of Mexican June and the flinty qualities of the native varieties. Work was also carried on with Mexican June corn for the purpose of increasing the yield and quality. Ten plats of 100 hills each from 10 selected ears were planted in July, 1910. Alternate rows were detasseled. Ten ears for the second planting were selected from stalks bearing two ears each in the detasseled rows and from the plat having the greatest yield. The plats in the first planting varied in yield from 15 to 75 kilos, with a total of 378 kilos. The plats in the second planting, which was made in November, varied in yield from 53 to 77 kilos, with a total of 642 kilos. This increase in yield may have been partly due to the fact that the second crop was given some fertilizer. At the Trinidad garden Mexican June corn grew and yielded very well during the dry season but very moderately during the rainy season. Corn has been grown at Alabang, La Granja Modelo and Ilagan, but for forage purposes rather than experimental work.

Pará grass.—Three plats of Pará grass growing at Singalong last year have been cut several times but no experimental work has been done with this grass. It has not been irrigated or cultivated but appears to be thriving. At the close of the year one or two of the plats of Pará appear to have become fairly rooted in an adjoining plat of *Paspalum*. One plat of Pará at the northern end of the station seems to have gained a decided ad-

vantage over the native weeds in the adjoining vacant lot for a distance of 1 or 2 meters and several healthy plants are well established among brambles and weeds at a distance of 5 meters from the original planting. One or two plants seem to be fairly rooted among *cogon.* It is noticeable that the stems of Pará grass have a tendency to lie on top of other vegetation, which of course retards its progress in forming new plants. It is probable that pasturing would aid in the establishment of this grass by pressing the recumbent stems to the ground. If this is true the inference is that with very little labor this grass could be successfully and profitably grown in pastures and out-of-the-way places now occupied by far less useful grasses. Pará grass at Singalong has, to date, resisted such drought and floods as have occurred, none of which, however, have been very severe. At the Trinidad garden Pará grass has grown quite well, giving a fair yield of forage.

Paspalum dilatatum.—Nothing has been done with this grass at Singalong except to cut it on one or two occasions when Guinea grass was scarce and the *Paspalum* especially tall. It is too short for satisfactory cutting and at Singalong there is no opportunity to pasture. It is noticeable that in one plat a native grass is gradually encroaching on the *Paspalum* while in other places Pará grass is making a similar encroachment. At the Trinidad garden *Paspalum* appears to be the most promising pasture grass that has yet been given a thorough trial. It does especially well during the rainy season.

Molasses grass.—This grass planted at Singalong in February germinated well but was of exceedingly slow growth. On May 26 some of the molasses grass was cut and fed to cattle and horses, which refused to eat much of it. More recently this grass has been fed regularly to two horses but up to the present time they prefer Guinea grass. After cutting, 50 per cent of the grass died. As yet no attempt has been made to cure molasses grass for hay. Seed of molasses grass was planted at Alabang in seed beds on March 13, 1911, but failed to germinate. On March 28 it was replanted and a few plants appeared. This failure to germinate was at the time supposed to be due to the destruction of the seed by a small species of red ant, as seed planted in April in boxes germinated perfectly in about five days. The seedlings thus obtained were transplanted to rows. Since that time the plants have grown but slowly. After several days of heavy rain in April a great deal of the seed planted in the seedbeds germinated, indicating that the seed did not have sufficient water when first planted. This grass has

not matured sufficiently to give any definite results in regard to its yield and feeding qualities. At the Lamao station molasses grass gave a dense, trailing growth which lodges badly. It has a strong odor and stock eat it very sparingly. When cut it does not send up a second growth readily and it does not cure well.

Tunis grass.—Planted in 3-meter rows it gave a good germination and rather slow growth. One row was cut when it had obtained a height of 1 meter. An attempt was made to cure the grass for hay, which was prevented by rains. The second row was left to mature seed. After the seed was harvested the grass was cut but it appears to be of little value.

Sudan grass.—This grass was planted both in drills and broadcast on February 18, 1911, at the Singalong station. In both cases it appears to have been planted too thick. That planted in drills was thinned out and the plants set in an additional two rows after cutting them back. They made a rapid growth and were cut during the latter part of May when about 2 meters high. The grass on this plat is now 1 meter high but not so vigorous as the first growth. The plat that was broadcast made a growth of $1\frac{1}{3}$ meters around the edges of the plat but not over two-thirds of a meter in the center. Recovery from cutting is slow. At the Lamao station Sudan grass produced tall, heavy plants 2 to $3\frac{1}{2}$ meters in height but too coarse for good forage. At the Alabang station this grass was sown on March 15 and 19, both in drills and broadcast. It was found that care must be taken not to seed too thickly. On both plats the crop is almost entirely free from weeds, the abundant foliage shading them out. Toward the latter part of April the grass began to head out and on May 28 the seed began to ripen. This grass could have been cut either for hay or for forage as early as the first of May but it was held over for the seed. Early in June a plat one-twentieth of a hectare in size was cut for hay. It produced at the rate of 11.2 tons to the hectare green weight and 5 tons when dried. The average height was 2 meters. This grass when fed green to horses and cattle is readily eaten by both.

Rhodes grass.—At the Singalong station this grass was planted on March 4, 1911, both in drills and broadcast. At the end of June that which was broadcasted had matured seed and was something over 1 meter in height. From June 18 to 30 daily cuttings were made for green forage. Recovery after cutting was good. This grass stands much better in drills than broadcast.

At Alabang Rhodes grass was seeded in rows on March 13, 14 and 15. Half of the plat was irrigated prior to planting and half subsequently. No difference in germination could be seen. The first seedlings were noticed on March 20. On April 14 part of the plat was transplanted. The transplanted roots appeared to do better than Guinea grass under similar treatment. It is considered essential that the transplanted roots be irrigated at the time of transplanting and twice later at intervals of three days. After this they may be handled the same as Guinea grass. On May 14 this grass, of the original planting, was waist high and had begun heading out. Rhodes grass, when planted from seed, matures in about six or seven weeks. Sufficient time has not elapsed since transplanting to state definitely when this will be ready to cut, but from general appearances it will take somewhat longer than Guinea grass, which requires about two months from time of transplanting. This grass lodges to some extent after a heavy rain. On May 28 this grass was cut for hay; it then had an average height of $1\frac{1}{3}$ meters and yielded 12,500 kilos per hectare green weight, or 4,190 kilos dry weight. When fed as green forage the animals eat Rhodes grass as readily as they do Guinea grass. As hay this grass appears to be equal to timothy. It has a clear, sweet odor and the horses eat it readily. At the Lamao station Rhodes grass seems to be the most promising plant grown for dry forage; it grows 1 meter in height, can be cut in six weeks with irrigation and cures easily. Rhodes grass at the Trinidad garden gave a tall, heavy growth and is one of the most promising grasses tried at this station. A small area cut on June 26 yielded at the rate of 44,559 kilos of green fodder per hectare.

Beggarweed.—At Singalong beggarweed was broadcasted on March 4 and a small cutting was made for green forage on May 26. The horses prefer Guinea grass. Recovery from cutting is doubtful. At the end of June the original planting was nearly 2 meters tall and had matured seed; the second growth was about two-thirds of a meter in height, very thick, and showed signs of seeding soon. Beggarweed was planted at Alabang on March 17 and was irrigated at the time of planting. The germination was almost perfect. It continued to do well until May 24 when several days of heavy rain occurred; after this a number of withered plants were noticed and on examination it was found that the roots of the affected plants had rotted away. This was particularly noticeable in the wetter portion of the field. On May 30 the seed was ripe and a small patch of it was cut and fed

to both horses and cattle. The horses ate it readily and when mixed with Guinea grass in all cases they picked out the beggarweed and ate it first. Only the leaves, however, were eaten, the stalks being rejected. The cattle, on the other hand, preferred sorghum and Guinea grass. When cut and fed with sorghum the whole mixture was quickly consumed. At the Lamao station beggarweed made a heavy growth of branching plants which were found to be fairly satisfactory for green forage.

Panicum hirsutissimum.—This grass planted on March 4 at Singalong appears to be much like Guinea grass, except that it has a recumbent stem and has been rather hard to establish.

Natal grass.—At the Lamao station this grass grew about 1 meter in height. It is comparatively fine in growth with dense, bushy clumps. Only a small amount was under observation and a further trial will be necessary for conclusive results.

Velvet beans.—Two hills each of 16 varieties of beans were planted at Singalong on March 16. All of these beans are on bamboo trellises 3 to 4 meters apart. One variety is particularly promising and it appears that several of the other varieties will give good results. At Lamao the same 16 varieties of beans were planted as at Alabang but none of them made a satisfactory growth.

Lyon beans.—At Lamao, Lyon beans planted in an old rice field, with no cultivation and no irrigation, made a very vigorous growth, covering the ground well and keeping down foreign growth. About 2,0ᴗ0 kilos of dry pods were obtained.

Cowpeas.—New Era and Clay Colored were planted at Lamao and made a fair growth; the New Era proving much the better of the two. It is a semi-climber with pods about 10 centimeters long and brownish beans, and is greatly superior to the native *sitao* in earliness of bearing and in yield. A field of 1,200 square meters planted on November 14 began bearing on December 30 and gave a total yield of 100 kilos of dry beans. Planted about 60 centimeters apart they made a dense mulch and are excellent both for a cover crop and for food. Cowpeas planted at Alabang have done fairly well though somewhat affected by rust and aphis.

Miscellaneous forage plants.—At Alabang, Colorado grass planted in March grew slowly and very poorly. This grass does not compare with either Guinea grass or Rhodes grass. Shabdar clover gave unsatisfactory results. At the Lamao station Colorado grass produced a small light growth about 90 centimeters in height. Mexican clover, a low almost creeping

plant, began producing small white blossoms when only a few centimeters high and appears to be of little value. At the Trinidad garden oats grown as cover crop during the rainy season gave a fair yield of forage. Sorghum has proven to be one of the best forage crops at this station. Alsike clover grown as a cover crop during the rainy season gave a satisfactory growth. Common red clover, sown extensively as a cover crop, gave a good stand and is one of the best cover crops tried. Kentucky blue grass was planted but failed to germinate. Siberian millet germinated well but quickly succumbed to the effect of heavy rains. Perennial rye gave a good growth and is also promising. Orchard grass gave results similar to perennial rye and is considered promising. Italian rye grass gave a tall, heavy growth. Fescue grass failed to germinate. Shabdar clover gave a good stand of rather slow growing plants. All of the legumes grown at the Trinidad garden have been found to be well supplied with tubercles.

HORTICULTURE.

The horticulturist, Mr. P. J. Wester, arrived in Manila on March 13, 1911, and reported for duty on March 14. He has begun a classification and study of the native fruits, vegetables, legumes, nuts, and root crops of the Islands. During the remainder of the fiscal year he visited twenty-one provinces and brought together a considerable number of varieties of fruits not heretofore studied in the Philippines. Photographs are being made and records kept as to measurements, weights, etc., of the principal fruits, such as the mango, citrus fruits, and avocado. In connection with the entomologist he has investigated several insect pests of the mango and citrus fruits and articles pertaining to these investigations have been published in the REVIEW. Nurseries have been started at the Singalong experiment station for the propagation of promising citrus, mango, and avocado varieties.

Mangos.—Work has begun on "topworking" old mango trees, which for unknown reasons are unproductive, with the object of budding these trees to standard varieties which are known to be normally productive. On a mango plantation having 1,400 trees at Muntinglupa, Rizal Province, experiments have been instituted and a careful study of the types of seedling mangos there in evidence is being made. A horticultural census taken in this mango orchard disclosed the rather astonishing fact that only 8 per cent of the trees bore an abundant crop and 15 per cent a good crop, while 28 per cent had a poor crop

and 49 per cent of the trees were unproductive, i. e., 23 per cent, or less than one-fourth of the trees, yielded a satisfactory return. This grove being the largest, and probably one of the best, in the Islands, it is fairly safe to assume that less than one-fourth of the mango trees in the Philippines are giving what a fruit grower would be justified in calling economic returns. By the comparatively simple methods of "topworking" and budding these unproductive trees, it is practically certain that within three years the mango crop of the Philippines could be not only standardized as to varieties but increased fully 100 per cent. It is estimated that in some districts fully one-half of the mango crop is lost through pests.

Bananas.—At the Lamao experiment station experimental work has been carried on with the following named varieties of bananas to test methods of culture and cost of production: *Matabia, lacatan, gloria, Chinese dwarf,* and *saba.* Six plats of 90 plants each, three of them with 30 additional plants of Chinese dwarf, were planted on May 31, 1910.

Papayas.—A plat containing 393 Hawaiian papaya trees was set out at the Lamao station on July 9, 1910. They proved very variable and the poor ones were cut out from time to time so that on June 30, 1911, there were 184 female and 35 male trees left. The first fruit ripened on March 27, 1911, about nine months after setting. About 8 kilos of seed have been secured.

Pineapples.—Of the varieties planted at Lamao on July 2, 1908, namely; Natal canning, Cuban queen, sugar loaf, maladuge, and red Spanish, only one variety, the Natal canning, is considered to be worth propagating. It bears fruits averaging 1 kilo in weight, 10 by 14 centimeters in size, smooth, nearly as large at the top as at the bottom, with very shallow cavities, and an almost entire absence of fiber and very little acidity. In appearance it resembles the Hawaiian variety grown here but has less fiber and acidity. Sugar loaf averaged 1 kilo in weight, 11 by 11 centimeters in size, tapering at the top, medium acidity, deep cavities and fibrous flesh. In some of the fruits the sections rotted on the inside before fully ripening. Maladuge averaged three-fourths of a kilo in weight, 9 by 12 centimeters in size and resembles the common native variety in shape and manner of growth. Red Spanish is rather acid and of poor quality. Cuban queen made a very poor growth. The fruits were very small and poor in quality.

Citrus fruits.—The pomelos and Lisbon lemons planted in

August, 1906, at Lamao are making a vigorous growth. The pomelos are 3 to 4½ meters in height but show no signs of bearing. The lemons have borne only a few fruits, which are of fairly good quality and turn yellow when ripe.

Avocado pears.—The trees set out at Lamao on September 15, 1905, are vigorous and healthy, average 4 to 5½ meters in height, but as yet show no signs of fruiting. The avocado pear tree at the Singalong station, which matured 16 pears last year, this year bore about 150 fruits.

Miscellaneous fruits.—Three varieties of roselle (*Hibiscus sabdariffa*) have been introduced and distributed to some extent. It is believed that the introduction of roselle into the Philippines will be a valuable addition to our fruits. Seeds of cherimoya (*Anona cherimolia*) and hybrid seeds of this species and of *Anona squamosa* were brought to the Philippines from Florida and a number of the seedlings are now growing at Singalong and Lamao. Stockplants of *Anona muricata, Anona squamosa, Anona reticulata* and *Anona glabra* are being grown at Singalong and Lamao to be used in the prospective importation of "large-fruited" cherimoyas from Australia and America. At the Lamao station experimental work is under way with a collection of 28 different native fruits and a number of different introduced fruits. Peach trees planted in 1906 blossomed fully during the past year and one tree has set a number of fruits. At Trinidad garden strawberries are now an important crop; nearly a hectare was grown this year. They commenced bearing December 20 and continued bearing until the end of the fiscal year. The most abundant yield and the best fruit was obtained during January and February. This is the most profitable crop grown at Trinidad, the sale amounted to ₱2,929.20 and during January hundreds of kilos of ripe fruit were not picked because of lack of buyers in Baguio. Mulberries have continued to grow rapidly and have yielded a fair amount of fruit. Blackberries and loganberries have been a failure.

Vegetables.—Commercial vegetable gardening has been carried on at the Trinidad garden, the best results having been obtained with beets, cabbage, kohlrabi, radishes, and turnips. Beans and peas did well in the dry season. At the Lamao station a large collection of both native and introduced vegetables are being grown for experimental purposes. The best results have been obtained with squashes, cucumbers, eggplant, tomatoes, okra, batao, mungo, and condol. White radishes and pechay also do well but produce very little seed.

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FIBERS.

The fiber expert has spent the larger part of his time on lecture and investigational work in the provinces and in the preparation of exhibits for different fairs and expositions. During the latter part of the fiscal year the most complete fiber exhibit that has ever been collected in these Islands was prepared by the fiber expert and taken by him to the Fiber Congress at Surabaya, Java.

Abacá.—The only station of the Bureau at which abacá is grown is La Granja Modelo in Occidental Negros. As laborers could not be obtained who were willing to strip the abacá on any terms other than for daily wages, and as this would have cost about the full value of the product no fiber has been produced this year, except some small samples for exhibition purposes.

Maguey.—The 20,000 native maguey plants and the 5,000 sisal plants at the Lamao station have made a good growth and now have leaves 1½ to 2 meters in length. Under conditions existing at this station the cleaning of maguey by *retting* has been found to be unprofitable. No attention is being given this crop at present.

Cotton.—Silk, wool, and alpaca varieties of Caravonica cotton were planted at Lamao on November 26, 1910. The wool variety did not germinate; the silk variety is now 160 to 240 centimeters in height with bushy, vigorous plants; the alpaca variety is 150 to 200 centimeters in height. The two latter varieties began blooming about the middle of February but produced no bolls worth harvesting.

Kapok.—Dahomey kapok, variety No. 1, planted on August 9, 1910, has made a good growth 3 to 4 meters in height and has a very spiny trunk; variety No. 2, planted December 9, 1910, is looking well, is 100 to 120 centimeters in height and has a smooth trunk. Native kapok planted in 1908 in a cogon field has nearly all died. That along the fence and by the roadways where it has received some cultivation has made a good growth and a few of the trees bore as high as 100 pods each this year.

MISCELLANEOUS PLANTS.

Rubber.—In January, 1911, about 120,000 seeds of Pará rubber were obtained from Singapore. The larger part of these seeds were planted at the Singalong experiment station, the remainder being sent to La Granja Modelo and to the quarantine station at Iloilo. About 35,000 plants were obtained from the lot planted at Singalong, about 1,200 at La Granja Modelo and about 750

PLATE III.—PARÁ SEEDLINGS IN BAMBOO TUBES, SINGALONG EXPERIMENT STATION.

at Iloilo. The germination of the seeds was approximately 30 per cent. The seedlings at Singalong are being sold at the rate of ₱3 per hundred, whereas those at La Granja Modelo and Iloilo are being distributed *gratis* in small lots to applicants. The old Ceara trees at La Granja Modelo were tapped during the month of December and samples of the rubber prepared therefrom were exhibited at the Bacolod Exposition and at the Manila Carnival.

Coffee.—At the Lamao station 230 plants of Liberian coffee set out in 1906 are in healthy condition and are about 2 meters in height. One hundred and forty-four plants of choice "robusta" from Java set out in 1909 have made a very vigorous growth and are now 130 to 180 centimeters in height with bushy tops. When one and one-half years old the trees bloomed abundantly. There is a good crop of berries about one-third grown at the present time. In appearance this variety resembles the Liberian. Twelve trees of Arabian coffee, planted in January, 1909, have made a poor growth; they are now 80 to 90 centimeters in height with bushy tops and have produced a few blossoms but no fruit. Thirty trees of Hawaiian coffee set out in June, 1910, have made a healthy growth and now average 1 meter in height. Thirty-six trees of Lavarian coffee planted in November, 1909, have made a healthy, bushy growth and are now 120 to 140 centimeters in height. They have not blossomed. Twelve trees of native calinog coffee planted in June, 1911, are looking well and are about 40 centimeters in height.

Sugar cane.—A number of varieties of Hawaiian cane have been received and planted at the Alabang stock farm. These canes, especially numbers H. 27, H. 309, and H. 227, have done very well. A considerable quantity of canes from the propagating plat have been sent to La Granja Modelo for trying out. A variety of Japanese cane has been recently introduced from California to be used as forage.

Cacao.—At the Lamao station 20 plants each of *Forastero* and *Caracas,* planted in July, 1909, have made a very poor growth averaging only 60 to 140 centimeters in height. Trees of the red and white varieties planted in 1908 have never borne fruit and have made a very poor growth.

Mulberry.—About 500 mulberry cuttings planted in July, 1908, at Lamao, have made an excellent growth and are now in good condition. Nearly 100,000 cuttings were distributed during the fiscal year ending June 30, 1910, and 20,700 during the past fiscal year. At present there are about 50,000 cuttings available for distribution.

Annatto.—At Lamao two plats of 36 plants each, one cultivated and the other on uncleared land without cultivation, were planted in November, 1909. The cultivated plat has made a vigorous growth and the plants are now 130 to 170 centimeters in height. The other plat has made a spindling growth with plants 100 to 130 centimeters in height.

Camotes.—Twelve varieties, secured from the Guam experiment station, were planted at Lamao in November, 1910, and have all made a fair growth. Only a small number of each variety were secured and a further trial will be necessary for a fair comparison.

Forest trees.—A tree nursery has been started at the Alabang stock farm with the idea of supplying legume and other trees for a test in reforesting cogon hillsides. In this nursery are planted a number of new varieties of trees from India, Australia and other parts of the world. Among the most useful of these may be mentioned a species of "mesquite" (*Prosopis juliflora*) imported from the Hawaiian Islands where the seeds and pods are largely used in the form of a meal for cattle feed. A special effort will be made to establish this tree on the poor soils of the Alabang hills, the idea being that the pods will furnish considerable feed for the live stock in the pastures while the trees will both benefit the soil and serve as windbreaks. There are also, in this nursery, several species of Australian gum tree (*Eucalyptus* sp.) and of Australian wattle (*Acacia* sp.), all of which give promise of successful growth here. The Bureau of Forestry has supplied a number of varieties of native trees, the majority of which are in a thriving condition.

SEED DISTRIBUTION.

The amount of garden seeds distributed during the year has been somewhat less than that of the previous year, as the Bureau of Education now supplies seeds for its provincial schools, whereas formerly this Bureau furnished seeds to such schools. However, 4,942 allotments of vegetable seeds, each collection containing about 10 separate packets, were distributed. Five hundred and sixty-one collections of flower seeds, 50 packages of ornamentals and miscellaneous seeds and several hundred packages of various legumes, abacá, kapok, fruits, etc., were sent out. One thousand, six hundred and seventy-eight kilos of Mexican June shelled corn and 11 sacks of corn in the ear were distributed. Other distributions of seeds and plants include 2,000 selected cacao pods, about 400 packages of papaya seeds, 400 pineapple suckers, 20,000 mulberry cuttings, 2,000 maguey suckers and about 1,200 maguey bulbils.

ENTOMOLOGICAL INVESTIGATIONS.

During the year the entomologist carried on investigations relative to plant pests—including locusts, insects, and rats—in 27 provinces. Particular attention has been paid to pests of sugar cane, coconuts, and fruits, although garden vegetables, bananas and other crops have received considerable attention. One hundred and five reports relative to pests affecting the various crops of the Archipelago have been received; 68 of these reports dealt with locusts, 12 with rats, and 6 with sugar cane.

In connection with the locust work the original law has been amended so that it is much more effective, and this together with circular letters sent out from time to time from the Executive Bureau at the request of this Bureau, have brought home to the local planters the fact that the locust pest may be greatly mitigated by proper methods and that coöperation in the work is necessary. During the past year locusts have been reported from something over 100 municipalities and barrios. The infestation area seems to be in a V-shaped region extending from Ambos Camarines through Masbate to Cebu and Bohol, then back through Negros, Iloilo and Capiz to Romblon. The insects, as reported, move from the southwest toward the northeast, being influenced more or less by the direction of the prevailing winds.

In the Province of Iloilo more than 200,000 cavans of young locusts were reported destroyed during the months of August, September and October; no sprays were used in this work, the antiquated driving method only being used. It was demonstrated at the Alabang stock farm, however, that a single spraying with sodium arsenate was effectual even in cogon grass.

From circular letters sent to the governors of the affected provinces, it has been possible to determine (1) The areas of greatest infestation; (2) the time of appearance and stages of the insects; (3) the direction and extent of movement of the swarms; (4) the equipment on hand, or required, for each province; (5) the proper points for establishing distributing stations for equipment when necessary. It is proposed to have constantly on hand in every district liable to be affected by locusts a supply of galvanized iron sheets for use in the popular method of driving the young insects.

If the policy of obtaining detailed reports from every district liable to infestation be carried out carefully, this Bureau will be enabled to determine with a fair degree of certainty the districts in which operations against the pest will be necessary and the extent to which outside assistance should be given, and

also to forecast the dates of expected outbreaks, and the probable routes of flying swarms.

During the latter half of the year a special study of the cigarette beetle has been made, both in the laboratory of the Bureau and in the tobacco factories of Manila. It is estimated that more than ₱200,000 damage is done to stored and manufactured tobacco in Manila or in export shipments therefrom, caused almost entirely by a species of *Lasioderma*. While a tremendous amount of damage is caused in the fields by the tobacco aphis, stemborer (*Chloridea obsoleta*), cut-worms, bud-worms (*Prodenia littoralis*), etc., and in the warehouses by the tobacco moth, the cigarette beetle is the principal pest which the tobacco dealers have to contend with in the Philippines.

Both refrigeration and fumigation, and a combination of the two methods, have been tried by several of the tobacco manufacturers of Manila. It appears that the freezing method has some value but is inadequate to destroy all eggs in the manufactured tobacco and a considerable percentage of the adult insects escape; fumigation with formaldehyde is inadvisable, but it remains to be seen whether in an ordinary factory carbon bisulphide is better than potassium cyanide as a killing agent. While each method has its advantages, it is believed that cyanide gas will be the more effective agent, when intelligently handled.

The great economy of the fumigating process is now appreciated by most of the manufacturers, although less than six months ago but little work had been done along this line in the Philippines. It is estimated that chemicals for the cyanide method costing less than ₱1 will serve to completely destroy all beetles *and their eggs* contained in 20,000 cigars or in a corresponding bulk of cigarettes: and carbon bisulphide, costing about ₱1 (1 kilo), should fumigate about five times this number of cigars. Some of the principal manufacturers have been advised in reference to improved systems of storage of the raw product, to insect-proof flooring, and to other improvements in the practical handling of both the raw and manufactured product. Within six months it is hoped the details of the fumigation processes in question will be worked out. It will be necessary for the manufacturers to use some sort of fumigation for at least a year or more before the pest can be eradicated. Material for a circular on the subject is in hand.

Serious losses are suffered from rats in cane and coconut districts, such as Pampanga, Batangas, La Laguna, Ambos Camarines, Samar, and Marinduque. Arsenic has been distributed to several planters in these districts, but until further experiments

PLATE IV.—IMPORTED NELLORE BULL AND COWS.

Property of the Bureau of Agriculture.

are made in trapping and poisoning, this pest will probably remain a very serious one and practically uncontrollable by any ordinary means. Investigations are under way to determine the most economic means of reducing the ravages of rats. It appears that at least 3 and probably 5 species of rats are concerned with cane and coconut damages; very little is known concerning the life history of these species.

In some of the mango districts insect pests reduce the crop more than one-half. The principal pests of the mango are the so-called "leaf-hoppers" (*Idiocerus* sp.), which attack the flower panicles, sucking the sap from the pedicels and thus weakening the minute fruits so that they drop off; a web-worm is common, but apparently does little damage to the crop; a fruit-fly, similar in habits to the Mexican fruit-fly (*Trypeta ludens*) does considerable damage to immature fruits in Luzon. In November a twig-borer was noted in mango trees at Santa Mesa; a similar, or identical pest has been noted near San Francisco, Cavite.

Little or no progress has been made with coconut insect pests. A species of *Coccidæ,* attacking the young nuts and flower stems of coconuts at Guiljugan, Oriental Negros, was noted, and a leaf scale was found to be abundant at Jaro, Iloilo.

Little work has been done on rice insects during the year, but it is proposed to follow a more detailed investigation of the rice-bug and stem-grub during the coming year.

Two maize pests have been observed, one attacking the stem by boring into it, and another, probably the tobacco leaf caterpillar (*Chloridea obsoleta*), attacking the developed ears.

A new citrus pest has been observed which is a small moth found defoliating the trees at Cagayan, Misamis. A small moth deposits its eggs on or in the rind of immature pomelos, the larvæ entering into the rind and causing unsightly blemishes on the mature fruits; this apparently attacks only the larger citrus fruits. Larvæ of a species of *Papilio* were noted attacking lemon trees at Daraga, Albay.

A bag-worm has been found attacking the bananas in several localities; the banana leaf-roller has been carefully studied and found to be well parasitized by one *Dipteron* and at least three species of *Hymenoptera,* one of the latter insects identified as a new species (*Chalcis thracis* Crawford) by the Bureau of Entomology, United States Department of Agriculture.

Sugar-cane insects have been studied at several points, especially at La Granja Modelo. It appears that a root beetle (*Holotrichia vidua*) is the most serious cane pest in the Philippines, in some areas temporarily necessitating abandonment of the

field. A red weevil (*Sphenophorus*) has been noticed in Negros canes. A woolly aphid (*Oregma lanigera*) is troublesome in some areas and a fulgorid (*Phenice moesta* Westw.) has been noted on cane in Occidental Negros.

At Misamis a very severe case of mistletoe parasitism on citrus trees was discovered by the entomologist; in some cases it seemed to be actually killing the trees.

The cabbage butterfly (*Pieris* sp.) has been more or less troublesome in cruciferous crops throughout the Archipelago; at the Trinidad garden hand-killing was tried with considerable success.

EXPERIMENT STATIONS.

On July 1, 1910, for administrative purposes, the work of the experiment stations and that of plant industry were organized as separate divisions. The operations of these two divisions are so closely allied, however, that it has seemed desirable to include under the general subject of "plant investigation" in the report of the division of plant industry a considerable part of the work done at the experiment stations.

GENERAL INVESTIGATIONS.

On October 15, 1910, Mr. O. W. Barrett, the chief of this division, reported for duty. During October visits of inspection were made to the Lamao experiment station and to the Tanauan and Lipa districts in the Province of Batangas. The Batangas inspection was for the purpose of selecting a site for a permanent experiment station.

In November visits were made to the Agricultural College at Los Baños and to the coconut districts of Santa Cruz, Majayjay, Lilio, and Pagsanjan in Laguna Province. The Alabang stock farm was also inspected with the object of outlining future plant industry work at that farm. During the latter part of November and the first half of December a trip was made to Iloilo, La Granja Modelo at La Carlota, Occidental Negros, and the Camp Vicars potato farm in Mindanao. During the latter part of December an inspection was made of the Calauan estate near Bay, Laguna Province, and a second inspection of the Tanauan district.

Early in January an inspection was made of the Trinidad garden and the Trinidad stock farm in the Province of Benguet. From February 2 to 14 a trip was made to Zamboanga for the purpose of giving lectures on rubber and coconut culture at the industrial exposition held at that place.

On March 2 a second inspection was made of the Lamao experiment station and during March trips were made to Lipa and Santo Tomas, Batangas Province. From March 16 to April 7 a trip was made to the Cagayan Valley for the purpose of inspecting the tobacco station at Ilagan. Several stops were made along the Cagayan River in the more important tobacco sections of that district. From April 15 to May 11 a trip was made to the Visayan Islands and to northern Mindanao for the purpose of general plant investigations. On May 29 and 30 the Luisita Estate at San Miguel, Tarlac, was visited with the object of planning rice work and forage experiments to be carried on at that place.

SINGALONG EXPERIMENT STATION.

The Singalong station, located in the city of Manila, is used principally as a receiving station for live stock handled by the Bureau in Manila, as a headquarters for transportation used by the Central Office, and for the growing of Guinea grass and other forage crops.

Supervision and labor.—This station has been under the supervision of Mr. W. H. Birch for the entire year. The average amount of labor used has been 22 men per day. The average daily wage paid this labor has been ₱0.909, and the total amount paid for labor ₱6,286.28.

Climatic conditions.—The weather conditions throughout the entire year were ordinarily favorable although some losses resulted from heavy rains which occurred in October and November. These losses, however, were more than compensated for by several rains which occurred during the dry season.

Fertilizers.—The station has used no chemical fertilizers during the year, the manure from the stables being sufficient for all of the crops and nurseries.

Pests.—One crop of corn (on a plat which had grown 5 crops during the previous nineteen months) was damaged considerably by the corn moth (*Pyrausta vastatrix*). White ants and wood borers damaged timbers in the buildings to some extent. Considerable damage was done by weevils in stored seeds and grain.

Crops.—The principal crops grown at Singalong during the year have been Guinea grass, corn, rubber and miscellaneous fruits and forage plants. About 75 varieties of economic and ornamental trees and shrubs are growing on the station grounds. Guinea grass roots, pineapple suckers, banana suckers, sisal plants, and cuttings and seeds of ornamentals have been distributed throughout the year from this station.

LAMAO EXPERIMENT STATION.

Supervision and labor.—The Lamao station has been under the supervision of Mr. O. B. Burrell for the entire year. Mr. Silverio Apostol, agricultural assistant, was in charge of the rice tests from April to December, 1910, and was again assigned for similar work in June, 1911. During the greater part of the year a sufficiency of labor has been obtained without difficulty at a wage of ₱0.75 per day. The total labor payrolls for the year, including the *capataz,* amounted to ₱3,631.04.

Climatic conditions.—The weather conditions have been exceptionally favorable. The rains were quite evenly distributed throughout the year, several good rains coming during the dry season.

Fertilizers.—Fertilizers to the value of ₱102.71 have been used, the greater part of this amount being for nitrate of soda (390 kilos) and tobacco waste (420 kilos).

Pests.—Comparatively little damage has been done by pests. Insects infesting the flowers of *cadios* were destroyed by spraying with lead arsenate. The same spray, however, had no appreciable effect on an apparently new pest attacking the buds and very young fruits of tomatoes.

Crops.—The principal crops grown at this station during the year have been upland rice, both native and introduced fruits and vegetables, coffee, and miscellaneous forage plants.

TRINIDAD GARDEN.

The Trinidad garden is located at Trinidad, subprovince of Benguet. Experimental work having been largely discontinued at this station, it is now used for commercial gardening and for the production of forage for the Trinidad stock farm.

Supervision and labor.—The Trinidad garden has been under the supervision of Mr. M. S. Haskell, agricultural inspector, for the entire year. The average number of laborers employed has been twenty-five; with the exception of one Japanese, the labor is about evenly divided between Ilocanos and Igorotes. The average daily wage was ₱0.655, or, excluding the *captaz,* ₱0.626, per day. The total amount of the labor payroll was ₱5,300.75.

Permanent improvements.—Among the more important improvements at this station during the year were a party-line telephone, a four-room dwelling house for laborers and an open wagon shed.

Climatic conditions.—The weather conditions have not been very favorable. One severe typhoon occurred on September 24, 1910. The dry season was longer and more severe than that

of the two preceding years. The total rainfall for the year was 3,653.79 millimeters (143.85 inches), which was considerably less than that of the preceding year. The extreme range of temperature was from 7.5°C to 33.5°C.

Irrigation and fertilizers.—The irrigation of crops was carried on between September 7 and April 20. There was at all times an abundance of water both for the station and for the local farmers in the valley. On account of the very heavy rainfall the soil at the station requires continual fertilizing. As very little manure is produced at the station the main dependence must be placed upon mineral fertilizers, though the chief need of the soil appears to be *humus.* A large quantity of tobacco waste has been applied to the strawberries, both for its fertilizing and insecticidal value.

Crops.—The strawberries proved the most profitable crop grown, the sales amounting to ₱2,929.20. During January, however, hundreds of kilos of ripe fruits were lost through lack of demand. Excellent results were also obtained with beets, cabbage, kohlrabi, radishes, and turnips. Beans and peas did well in the dry season. Tomatoes failed on account of a fungus disease apparently introduced from Australia with the seeds. The forage crops have done fairly well, especially Rhodes grass and *Paspalum dilatatum.* A large variety of legumes and grasses are being tested.

The total receipts for this station were ₱7,104.74, which amount exceeds the total of the pay rolls by ₱1,803.99. A considerable amount of forage was produced at this station and delivered at the Trinidad stock farm. The value of this forage, however, is not reckoned in the produce accounts. Unfortunately the "Baguio season" and the crop growing season at the Trinidad garden do not coincide very closely, otherwise the receipts from vegetable sales would be largely increased.

LA GRANJA MODELO.

This farm, which was established by the Spanish Government as an experiment station for work with sugar cane, is located at La Carlota, Occidental Negros. It is operated in a small way for the commercial production of sugar; is used for experimental work with sugar cane, grasses and other plants; and during the past year it has also been used as a stock farm.

Supervision and labor.—This farm was under the supervision of Mr. R. E. Burris from the beginning of the fiscal year until October, 1910, when he was relieved by Mr. H. J. Gallagher. There has been a shortage of labor throughout the year and the

quality of the labor has been inferior as compared with previous years. At least 20 per cent more laborers should be employed during the harvest and milling season than have been employed during the past year. On account of the impracticability of following the usual custom of advancing money to laborers before they begin work it was found necessary to increase the wage of the field men from ₱0.50 to ₱0.60 per day. Previous to December, 1910, ordinary field men were paid ₱0.50; extra good men, those caring for the horses, received ₱0.60 per day.

Climatic conditions.—The fiscal year covered by this report was one of unusual rainfall in the La Carlota district, particularly during the months from December to April. During this period, which is usually comparatively dry, about 431 millimeters (17 inches) of rain fell. The total rainfall for the year was 2,669.8 millimeters (105.11 inches).

Water supply.—During the dry season this farm has not enough water for irrigation purposes unless the three sugar mills located on the stream below the station are more or less deprived of their necessary quota of water power. From June to November water could have been taken from the Najalin River to irrigate several hundred hectares of rice land. With a reservoir in which water could be stored during the night a sufficient supply of water would be available during the day time without discommoding the down stream sugar mills. Without such a reservoir extensive irrigation is impracticable.

Permanent improvements.—During the year the dwelling house of the superintendent, the fuel shed and the sugar mill have been repaired, and a house for the stable foreman, four concrete culverts and wire fencing have been constructed.

Fertilizer experiments.—In January 4,600 kilos of fertilizers were donated to this station by a commercial firm in Manila for experimental work. The greater part of this fertilizer has been used during the year. As the donators were very anxious to have the fertilizer used immediately the greater part of it was applied to plant canes. The results thus far obtained, naturally, have been unsatisfactory. This is largely due to the fact that the fields in which the experiments were made are rich in plant food and are maintained in excellent tilth. Very satisfactory results were obtained from the application of fertilizers on plats of Guinea grass.

Pests.—During July and August, 1910, the farm was visited by several swarms of locusts which deposited their eggs in the neighborhood. When these eggs hatched it required the entire farm force to destroy the young hoppers, this work costing about

Plate V.—IMPORTED NELLORE BULLOCKS.

₱100. Since September there have been no locusts in the district.

The cane root beetle severely damaged a few hectares of cane. This pest is apparently confined to several areas where the soil is very loose. Some of the infected areas have been abandoned but appear to be as badly infected even after several years as they were when cultivation was first discontinued.

At least one species of cane borer attacked the cane, not causing any great loss, yet doing sufficient damage to demand careful investigation during the coming year. This borer seems to be confined to the imported cane, especially the striped Louisiana variety.

Crops.—The principal crop at this farm is sugar cane. Other crops grown are Guinea grass, rice, corn, sisal, abacá, rubber, and miscellaneous forage crops.

During the planting season some 28 hectares were planted in cane, about half being native varieties and half Hawaiian canes. This, with the ratoon fields, will give approximately 40 hectares for the ensuing crop. About 12 hectares of the plant cane were planted sparsely with corn at the same time. The object of this was to prevent the cane from growing too rank and also to produce grain for the live stock.

BACOLOD EXPOSITION.

The farm sent the following exhibit to the Agricultural and Industrial Exposition held at Bacolod from December 30, 1910, to January 4, 1911: Four head of Nellore cattle, 2 Berkshire boars, samples of 6 varieties of sugar cane, 1 sample of sisal fiber and 1 sample of Ceara rubber. This exhibit was awarded a "bronze medal of honor" and the municipality of La Carlota, materially assisted by this contribution, was awarded the "first municipal agricultural prize." The live stock exhibit attracted a great deal of attention as evidenced by the many inquiries regarding live stock received by the superintendent since that time.

ILAGAN TOBACCO STATION.

The Ilagan tobacco station, located at Ilagan, Isabela Province, was established for the purpose of conducting experimental and demonstration work with tobacco. This station also serves as a headquarters for agricultural extension work carried on in the Cagayan Valley.

Supervision and labor.—This station was under the supervision of Mr. Charles A. Mahan from the beginning of the fiscal

year until March 30, 1911, when he was relieved by Mr. R. W. Rowe. In accordance with the project for carrying on tobacco work in the Cagayan Valley outside of the station grounds, two Filipino inspectors were secured during May, 1911. It has been found necessary to discharge one of these inspectors, but the other one is doing good work. The principal duty of the inspectors at present is to instruct the local planters how to properly save and sow tobacco seed on their plantations. There has been considerable difficulty in securing sufficient labor even for the small area of ground under cultivation at this station. The labor is of low grade at best and certain local customs which the station can not adhere to render the employment of permanent labor a precarious matter.

Permanent improvements.—A large store house, at present used for storing implements, has been built during the year. On April 1, 1911, work was started on a building to be used both as a residence and office for the superintendent. This building was not entirely completed at the close of the fiscal year.

Crops.—During Mr. Mahan's tenure about 2 hectares of the best land at the station was cleared, fenced and put under cultivation. Two fields of tobacco were set out, one of 8,150 square meters, the other of 8,639 square meters. About 700 tobacco plants were selected for seed and these were bagged and tagged, each type being kept separate. This seed was cleaned and will be used the coming season in continuing tests of local tobacco types.

A field of corn has recently been planted and tests of several legume crops are being made.

MACHINERY AND BUILDING DIVISION.

Forage factory.—The work of the forage factory during the past year has been largely in the handling, curing, storing, and preparation of corn in various combinations with other feeds to form a grain mixture to be used as a substitute for oats. Corn is the only grain grown in the Philippine Islands, outside of rice, which can be obtained in the large commercial quantities required in the manufacture of forage. The greater part of the crop of corn grown in the vicinity of Manila matures during the months of July and August. This is in the midst of the rainy season and the corn must be handled in the ear, as the fresh shelled corn will ferment and heat in a short while unless thoroughly dried.

The forage factory has been without proper storage facilities, but secured the use of one of the cattle sheds in the stockyards, in which the ear corn purchased was stored to a depth of 2 meters

on a concrete floor; when thoroughly dry it was shelled and stored in an almost air-tight bin, 3 meters square and 5 meters deep. A bamboo, with perforated joints, was inserted vertically in the center of the bin and carbon bisulphide introduced through this opening, with a view to killing the weevils which had attacked the corn while curing in the shed. The weevil is the greatest enemy of stored corn in the Philippines and its effective control is a problem deserving considerable attention.

The experiences of the past year show that it will be necessary to provide a lot of large iron tanks, holding from 20 to 50 tons of shelled corn, and so construct them that they will be proof against the invasion of weevils and moisture. They can be provided with a manhole at the top so as to be filled from a chain carrier and a grain chute at the bottom from which the corn can be taken out, and will probably require perforated pipes through which a hot-air blast can be driven for drying out corn received before it is fully cured.

During the year the factory has prepared 706 metric tons of grain feed which was disposed of for ₱48,883.89, or a little less than ₱70 per ton. Six hundred and forty tons of this amount consisted of the grain mixture containing from 50 to 60 per cent of ground corn and 50 tons of pure corn meal. The expenses of the forage factory during the year, for maintenance, operation, and materials, were ₱47,310.58, which gives a small profit over its operation. This forage was used principally by the Bureau of Agriculture in feeding the farm animals, by the city of Manila for feeding its draft stock, and by the quartermaster's corral at Pasay in the feeding tests conducted by the forage board.

Permanent improvements to the value of ₱6,589.03 were made at the factory during the year. These consisted principally in the installation of an 80-horsepower tubular boiler, a 50-horsepower engine, and a small amount of tramway track and cars for handling the forage products. A small addition was also made to the machinery by the installation of additional corn mills, shellers, a mixer, and an ensilage cutter.

It has proven impracticable to secure a green fodder of any kind at prices low enough to warrant curing same by artificial heat for the production of hay. The greatest success has been attained in encouragement of corn growers in the hand-stripping and curing of corn-blade fodder. However, it is doubtful if this can be shipped from the provinces to the forage factory to be cut, baled, or otherwise processed, at a cost lower than imported hay of an equal grade. The probabilities are that this branch

of forage production can be carried on best by the individual farmer stripping, curing, and baling the corn fodder on his farm and selling it direct to the dealer or consumer, without incurring further expense.

Power plowing.—The investigations of previous years have been quite conclusive to the effect that traction plowing, with the ordinary types of heavy traction engines, is not practicable in most parts of the Philippine Islands. No further work was done along these lines except the operation, for a short while, of a petroleum engine previously purchased. This Bureau was unable to obtain a cable plowing outfit on account of lack of necessary funds, but it is highly desirable to give this system of plowing a thorough test as soon as the necessary machinery can be purchased.

During the year there has been considerable interest shown in the subject of light farm motors, a class of machinery which received the special attention of the Director of Agriculture during his visit to Europe and the United States the previous year. So far, only one make of this class of machinery has been offered for sale in the Philippines and only a limited opportunity was offered for giving it a test. It is a gasoline motor truck with a 28-horsepower four-cylinder engine with auto-starter and, in general construction, is the same as an ordinary motor truck and has a gross weight of about 2,500 kilos. The engine shaft extends out in front of the engine far enough for the attachment of a belt pulley for use when the machine is required for driving small farm machinery, such as corn mills, threshing machines, and irrigation pumps. The rear wheels have extension rims and automatic folding mudhooks. This motor was tested for plowing, harrowing, and for running a centrifugal pump and, in general, gave very satisfactory results. For field work it was operated at first without load but it soon developed that it did not have sufficient adhesion to avoid slipping of the traction wheels; this was overcome by desiging a special rim with diamond mudhooks and loading the truck over the rear wheels.

This class of motor has the advantages of being sufficiently light to pass over almost any type of bridge which is safe for cart transportation; uses a liquid fuel; is easy to transport anywhere; requires no water and can be used as an ordinary automobile truck when not required for farm work. It has the disadvantages of requiring a skilled operator to keep it in good running order; is rather high in original cost and will probably not remain in serviceable condition a great many years like a steam engine.

Other farm machinery.—This division has devoted considerable attention to the selection and installation of several items of machinery on the farms of the Bureau of Agriculture, other than at the forage factory. Among these were the erection of temporary water-works for the stockyards in Pandacan, consisting of a centrifugal pump operated by an electric motor, a riveted steel tank, and necessary pipe lines. This was replaced at the close of the year by the installation of the city water mains in the stockyards.

The pumping machinery used at the Singalong station proved unsatisfactory and was replaced with an air compressor, pressure tank, and the necessary piping for lifting water from the artesian well into the tank at an elevation of about 8 meters. The compressor was operated by an electric motor previously used for driving the pumps. At the Alabang stock farm an engine, line shaft, and two triplex pumps were installed for pumping water to a supply tank and for irrigation purposes. A second artesian well was bored near the one previously in use and the two were connected so as to flow into a large concrete cistern, with which the pumps were connected. A four-inch centrifugal pump with portable engine was installed for pumping water from a stream on the farm for irrigation purposes. An automatic gas plant was installed at the veterinary laboratory at Alabang and a small repair shop was opened at the forage factory for the purpose of keeping in repair all automobiles and motorcycles used by the Bureau of Agriculture.

Expert advice.—During the year many persons, contemplating the purchase of farm machinery or desiring information as to the best types and makes, have consulted the machinery expert of this division and have been furnished, as far as possible, with the information which they desired. Some parts of this work, such as that pertaining to copra driers, hemp machines, and sugar mills, have been handled by other specialists in the Bureau who were specially posted on these different classes of machinery.

Buildings.—A number of buildings have been constructed on the farms of the Bureau during the year, and others have been altered and repaired. This work was mainly at the Alabang stock farm where a number of mixed-material residences and light-material cottages for laborers were erected. Five buildings were constructed on the Carnival grounds for the reception of the live-stock exhibit during the month of February, and at the close of the Carnival were removed and the material used in the construction work at Alabang.

AGRICULTURAL EXTENSION WORK.

Nature of work.—The object of agricultural extension work is to provide a means by which the results of agricultural investigation and experiment may be transmitted to the man on the farm, and thereby made of economic value. The more important lines of agricultural extension work are as follows: Lecture work, inspection work, coöperative demonstration work, agricultural fairs and exhibits, agricultural associations, and distribution of printed matter.

Organization.—An extension work campaign along the lines above mentioned was organized early in the year. The results obtained have been highly satisfactory and indicate the desirability of developing this work as rapidly as may be practicable.

Lecture work.—During July and August, 1910, several extension work lectures, together with lantern slides, charts and other illustrative material, were prepared. From August, 1910, to January, 1911, 6 different employees of the Bureau devoted a part of their time to lecture work. One hundred and sixteen lectures were given in 18 provinces. The enthusiasm with which these lectures were received by the people far exceeded what had been expected. At the close of each lecture the people present were invited to question the speaker, and questions covering all phases of the subjects of the lectures were asked. Requests for lectures were received from many more municipalities than could be visited, and there was every indication that this form of extension work is one that can profitably be used in all of the provinces.

Inspection work.—Probably the most satisfactory means of disseminating agricultural information in these Islands is by the use of well-trained field inspectors, who shall travel through the provinces, visit the farmers on their farms, and not only tell them what to do but also show how improved methods should be carried out. Two agricultural inspectors and one assistant inspector have been detailed on work of this nature in the Visayan Islands during a part of the year.

Coöperative demonstration work.—The object of coöperative demonstration work is to provide practical object lessons in improved methods of farming and to secure active participation in such demonstrations by the farmers themselves. This work is closely related to that of field inspector, and our field inspectors have undertaken during the year to interest the people in this work. Many of the more prominent farmers in different prov-

PLATE VI.—TYPES OF COCONUTS.

inces have expressed a willingness and desire to assist in coöperative demonstration work at such time as the Bureau shall have the men to furnish the supervision required.

Fairs and exhibits.—The holding of agricultural fairs and shows is a popular, and in many ways a valuable means of agricultural educational work. In the Philippine Islands this work is covered by the annual Carnival held in Manila, and the expositions held at the different provincial capitals. The Bureau of Agriculture has taken an active part in these fairs during the past year, both in the preparation of exhibits and in furnishing lectures on agricultural subjects. Large exhibits of both live stock and plant products were made at the last Carnival. Exhibits and lectures were also sent to the fairs held at Zamboanga and Bacolod, and a lecturer was detailed to the fair held at Lingayen. A very creditable exhibit of the agricultural products of the Philippines was prepared and forwarded to the Annual Agri-Horticultural Show held at Singapore. During the latter part of the year covered by this report a very complete exhibit of the fibers and fiber products of the Islands was prepared and taken in person by the fiber expert of the Bureau to the Fiber Congress held at Surabaya, Java.

Agricultural associations.—The necessary arrangements were made by this Bureau for holding the annual conference of the Insular Agricultural Association in Manila during the week of the Carnival. This conference was held in the Marble Hall of the Ayuntamiento, and covered a period of four days. A number of prominent speakers were present, including Prof. C. V. Piper. agrostologist of the United States Department of Agriculture. Considerable interest is now being shown in agricultural association work, and several provinces have organized local associations during the year.

PUBLICATIONS.

THE PHILIPPINE AGRICULTURAL REVIEW.—In the preparation of the REVIEW, the aim has been during the past year to cover more thoroughly than in former years the field of Philippine agriculture, eliminating in a large measure the reprinting of material already published in other tropical magazines. As a result of this policy, the REVIEW has been made up almost entirely of original material, prepared principally by employees of this Bureau. Another prominent feature has been the increased space given to the publication of matter pertaining to veterinary and animal husbandry work. Constant attention has been given

to the correction and revision of the mailing list. The REVIEW now occupies a well-recognized place among the agricultural publications of the world. The local demand for it has become much greater than can be supplied, and it is only a question of time when it will become necessary to place this publication on a subscription basis.

Other publications.—Three bulletins have been published in English and three in Spanish during the year. Bulletin No. 7, "The Garden," which was proven to be one of the most popular bulletins of the Bureau, has been revised and now includes the subjects of cacao, coffee, bananas, and oranges. Farmers' Bulletin No. 12, "Abacá (Manila hemp)," has been revised. Farmers' Bulletin Nos. 16 and 17, "The Cultivation of Tobacco in the Philippine Islands," and "Coconut Culture," are new bulletins. The tobacco bulletin has been published in the Ilocano and Ibanag dialects, as well as in English and Spanish. Fifty thousand circulars, containing elementary information regarding rinderpest, have been published in English, Spanish, Tagalog, Visayan and Ilocano. Small editions of 9 different reprints from the REVIEW have been printed. The following is a complete list of the publications of the Bureau for the year:

	English.	Spanish.	Local dialects.
The Philippine Agricultural Review	38,150	44,600	
Bulletins:			
Bulletin No. 7, "The Garden"	2,500	2,000	
Farmers' Bulletin No. 12 (revised edition), "Abacá (Manila hemp)"		2,000	
Farmers' Bulletin No. 16, "The Cultivation of Tobacco in the Philippines"	2,000	3,000	
Ilocano			2,000
Ibanag			2,000
Farmers' Bulletin No. 17, "Coconut Culture"	2,500		
Circulars:			
Rinderpest Circular No. 1—			
English and Spanish		20,000	
English and Tagalog			10,000
English and Visayan			10,000
English and Ilocano			10,000
Reprints:			
Pleuro-pneumonia in Cattle	100		
Agricultural Extension Work Lecture, No. 1, "The Cultivation of Corn in the Philippine Islands"	200	200	
Agricultural Extension Work Lecture, No. 2, "The Vegetable Garden"	200	200	
Agricultural Extension Work Lecture, No. 3, "Abacá (Manila hemp)"	200	300	
Fertilizers	200	200	
The Agricultural Association and its Value to the Philippine Farmer	100	200	
Constitution and by-laws of the Insular Agricultural Association of the Philippine Islands	200	300	
Statistics regarding Hemp and Rice in the Philippine Islands	100		
Statistics regarding Sugar Cane and Tobacco in the Philippine Islands	100		
Total	46,550	73,000	34,000

CROP REPORTING AND STATISTICS.

The collection and compilation of crop and live-stock statistics for the Islands, by means of the quarterly crop reports, comprises the major part of the work of the statistical division. There is a constantly growing demand from year to year for detailed information regarding crop areas and yields in the Philippines, and such information must necessarily be based on carefully compiled statistics. There is also a demand for current information concerning crop conditions. These data are obtained by means of monthly reports received from employees of this Bureau, senior inspectors of the Bureau of Constabulary, and provincial governors. The collection of live stock statistics is especially provided for by Executive Order No. 24, dated March 31, 1911, which provides that municipal presidents shall prepare an accurate statement of the domestic animals in their respective municipalities, giving the name and address of the owner and the number of animals of each class, the location where they are kept and the name and address of the caretaker when he is other than the owner. It further provides that such lists shall be revised subsequently every six months, on the first of January and July of each year.

Act 1898, making it the duty of all municipal presidents to furnish the Bureau of Agriculture with quarterly crop and live-stock statistics, has now been in operation two years. During the year just ended there has been a marked improvement both in the degree of correctness of the reports received and in the promptness with which they have been sent in. The total number of quarterly reports received for the fiscal year just closed was 3,103 as compared with 2,636 for the previous fiscal year.

For the purpose of disseminating information regarding the crop-reporting work the statistician has attended a number of assemblies of municipal presidents held at the provincial capitals and a traveling inspector has been kept in the field during the greater part of the year. At the assemblies above referred to the local officials have been shown the direct advantages to the people of keeping this Bureau informed as to actual existing conditions regarding crops and farm animals and have been furnished with detailed information regarding the method of preparing the crop reports. The traveling inspector has visited every municipality in the provinces to which he has been detailed and has furnished local officials with still further information regarding the crop-reporting work.

Early in the year it was deemed best to discontinue the monthly municipal crop reports as it was hoped that by concentrating all of their energies upon the quarterly reports the presidents would give to them more time and attention, resulting in greater accuracy and completeness. These monthly crop reports have been replaced by a Monthly Summary of Crop Conditions furnished by each provincial governor under the provisions of Executive Order No. 13. These monthly reports will be compiled and furnished the daily press of Manila and the Bureau of Insular Affairs.

Blank forms have been prepared to be used in the preparation of the live-stock reports provided for by Executive Order No. 24. These forms will be distributed so as to be used for the July, 1911, report. The comprehensive live-stock statistics that will be obtained under the provisions of this Executive Order will be of particular value in connection with the work of controlling and eradicating animal diseases.

SPECIAL INVESTIGATIONS.

The local production of an abundant supply of satisfactory forage for both native and imported live stock is a line of work of great economic importance in these Islands, and one that has been given special prominence during the year covered by this report. The investigations with various forage plants carried on by the Bureau at its different stations and farms, and the work of the forage factory have already been discussed in detail. In addition to this regular work, there have been, also, two special forage investigations with which the Bureau has been directly connected; one by Prof. C. V. Piper, agrostologist of the United States Department of Agriculture, the other by a forage board appointed by the Secretary of War. The reports of these two investigations are to be published in the August, 1911, number of the PHILIPPINE AGRICULTURAL REVIEW.

Investigations by Prof. C. V. Piper.—The object of Professor Piper's investigations was to ascertain, by personal observation, the existing conditions in these Islands with respect to the local production of forage with a view to the improvement of the situation. Professor Piper arrived in Manila on February 12, 1911, and his work in the Islands covered a period of nearly five months. During this time he visited many of the provinces, carried on tests with forage plants at the stations and farms of the Bureau, introduced a number of new forage plants, and outlined work to be carried on during the coming year.

The forage board.—On September 1, 1910, the Secretary of

War appointed a board of officers of the Civil Government of the Philippine Islands and of the United States Army to investigate and report upon the present cost of forage for use of the Army in the Philippine Islands. This board was directed, after careful and exhaustive consideration, to report whether native forage can be substituted for that now used, and if so, to what extent; the advisibility of using, in part, native grasses grown in the vicinity of the various posts, with a view to reducing transportation; the relative cost of the two, and what methods, if any, should be adopted for procuring native forage; and, if deemed necessary, to conduct experiments for the purpose of ascertaining the utility and cost of production of native forage. The board was also directed to consider the question of using, wholly or in part, *native beef* for the Army in the Philippine Islands. The Director of Agriculture was a member of this Board, and several employees of the Bureau have devoted considerable time to matters pertaining to its investigations.

The first meeting of the board was held on September 5, 1910, and its investigations were continued through the remainder of the fiscal year. These investigations were conducted with thoroughness and great detail, and a large amount of valuable data was obtained, which will no doubt prove of great value and economy in the maintenance of Government live stock.

Very respectfully,

G. E. NESOM,
Director of Agriculture.

The Honorable,
the SECRETARY OF PUBLIC INSTRUCTION,
Manila.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—OCTOBER.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

		Manila.	Cebu.	Iloilo.	Total.
Rice	Kilos	8, 183, 080	7, 289, 876	2, 720, 853	18, 194, 529
	Value	410, 866	345, 713	124, 075	880, 654
Beef cattle	Numbers	1, 007		651	1, 658
	Value	23, 934		26, 275	50, 209
Sugar	Kilos	338, 306	47, 762	43, 059	429, 127
	Value	25, 974	3, 859	3, 589	33, 422
Coffee	Kilos	35, 633	246	204	36, 083
	Value	11, 618	74	115	11, 807
Cacao	Kilos	37, 624			37, 624
	Value	13, 605			13, 605
Eggs	Dozens	345, 393	177	158	345, 728
	Value	25, 497	20	18	25, 535
Raw cotton	Kilos				
	Value				

EXPORTS.

		Manila.	Cebu.	Iloilo.	Total.
Hemp	Kilos	6, 790, 121	1, 732, 759		8, 522, 880
	Value	755, 340	183, 020		938, 360
Sugar	Kilos	2, 447, 521		225, 996	2, 673, 517
	Value	176, 993		9, 125	186, 118
Copra	Kilos	10, 344, 545	2, 932, 945	100, 447	13, 377, 937
	Value	1, 014, 033	299, 000	9, 624	1, 322, 657
Cigars	Numbers	14, 828, 666			14, 828, 666
	Value	229, 640			229, 640
Cigarettes	Numbers	2, 887, 150			2, 887, 150
	Value	2, 351			2, 351
Tobacco	Kilos	1, 202, 760			1, 202, 760
	Value	162, 895			162, 895

a

b

PLATE I.—(*a*) AN ALL-WHITE YAM FROM BOHOL. (*b*) THE RED WHITE YAM.

THE PHILIPPINE
Agricultural Review

VOL. V FEBRUARY, 1912 No. 2

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

A FEDERAL VETERINARIAN FOR THE PHILIPPINES.

The needs of the work of cattle quarantine and meat inspection have emphasized the necessity of having in the Bureau of Agriculture, for a time at least, a man thoroughly familiar with the practice of the United States Department of Agriculture in these matters. Through the courtesy of the Secretary of Agriculture, and of the Chief of the Bureau of Animal Industry, at Washington, permission has been granted to Dr. George S. Baker, inspector of the port of San Francisco, and inspector in charge of the meat inspection station at San Francisco, to spend

a year's leave of absence in the employ of the Bureau of Agriculture in the Philippines, with the intention of returning to his former employment at the expiration of that time. Dr. Baker is too valuable a man to the Bureau of Animal Industry to warrant his permanent separation from that Bureau, but it is confidently believed that during his year in the Philippines he may organize the meat inspection and quarantine service of the veterinary division of this Bureau, and place the work in such a condition that it may be permanently carried on with the efficiency of that of the United States Department of Agriculture.

Dr. Baker is a veteran in the service of the Bureau of Animal Industry, having been employed in the Bureau from the first year of the organization of the meat inspection work, was appointed to the Chicago station in 1891, and transferred to San Francisco in 1895, where he has been continuously until coming here.

During his term in San Francisco, he organized the meat inspection service, a quarantine service for the Port of San Francisco, handled the exportation and interstate movement of live stock, and coöperated with the State in the eradication of glanders and tuberculosis. His work of supervising the exportation of horses and cattle to Hawaii made him practically the guardian of the live-stock interests of that territory, in that he was able to prevent the exportation of diseased animals from San Francisco. About 6,000 head of horses, mules, and cattle, are shipped to Hawaii annually, and during Dr. Baker's recent visit to Honolulu the board of commissioners of agriculture and forestry tendered him a congratulatory letter pointing out that during his term as inspector of the port of San Francisco not a single diseased animal had been received from California.

The meat inspection work involves the ante-mortem and post-mortem inspection of about 3,500 animals, and the manufacture of about 100,000 pounds of meat food products daily. Besides the matter of meat inspection and cattle exportation, Dr. Baker's judgment will be of great utility to the Bureau in other matters pertaining to the interisland movement of animals and the shipment of live stock by rail.

Dr. Baker is one of the leaders in the movement for clean milk in California, is a member of the San Francisco County Medical Society Milk Commission, and is prominently identified with the State Association of Medical Milk Commissions.

He is also a member of the National Association of Medical Milk Commissions, and has contributed freely to the literature

of the relation of milk to the public health, and to the relations of bovine tuberculosis to the public health. He is also a member of the California Public Health League, and of the State Commission on Tuberculosis.

Before entering the veterinary profession, Dr. Baker secured an arts degree from McGill University in Montreal, Canada, returning a few years later to his alma mater for his veterinary degree.

CIRCULAR NO. 12.

DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE,
Manila, P. I., December 1, 1911.

PLANT PEST REMEDIES.

By P. J. WESTER, *Horticulturist.*

Plants are sometimes attacked by insects or by parasitic vegetable organisms that destroy part or all of the plant attacked. Fortunately the insects are in many instances preyed upon in their turn by insect parasites or parasitic fungi which increase rapidly when climatic and other conditions are favorable for their development; thus many pests that but for these parasites would always be a serious danger to many agricultural crops are kept in check by natural agencies. This is particularly true of many insect pests in the Philippines.

However, it may sometimes be found necessary to combat an insect pest or a disease by the application of a fungicide or insecticide, according to its respective use. These mixtures are commonly called "sprays."

A fungicide is a mixture employed in the control of a disease caused by a fungus. The dead or dying branches or twigs in a shrub or tree infested with a fungus disease should be pruned out before spraying to render the latter more effective. It should be remembered that a fungus that has entered into the bark and wood cannot be destroyed by a spray. The mission of the fungicide is to prevent reinfestation of the plant by the fungus by the coating of the plant with a material that on contact destroys the fungus.

The term insecticide denotes a spray that is used in the warfare against insects.

Insect pests that can be controlled by spraying are divided into:

(*a*) *Biting insects*, such as caterpillars or larvæ of various butterflies, moths, or beetles, locusts etc., in fact any insect that *eats* the leaves or twigs of plants; these pests may be destroyed directly by spraying the plants with a solution containing a poison, usually arsenic.

(*b*) *Sucking insects,* which attach themselves to the leaves, twigs or trunks of plants or trees and weaken or destroy parts of the plant or when they are present in large numbers, even kill it. Among such insects are the mango hoppers that in some seasons destroy the mango-bloom; the various scale insects that infest the mango, citrus and many other fruit trees; the mealy bugs; several species of very small insects, hardly visible to the naked eye, called mites, that sometimes discolor some of the citrus fruits by puncturing them and sucking out the juice; and the aphids, or as they are commonly called, "green flies." The sucking insects are controlled by "contact sprays," so named because they kill the insects by contact, i. e., by closing up their breathing pores.

(*c*) *The fruit flies,* which lay their eggs on young or nearly mature fruits of certain species of plants, the larvæ after hatching entering the flesh of the fruit and destroying it. These are controlled by poisonous bait sprayed on the trees they infest.

In order to be effective, the spraying should be thorough and the application liberal. The pressure should be sufficient to cause the spray to settle on the plants as a fine mist and not in large drops. *It is advisable in using sprays whose effect on a certain plant is not well known, to spray a few plants and wait a few days to see if any ill effects appear before spraying the whole orchard or field.*

For the small grower the "knapsack" or compressed air sprayer that can be carried on the back by a man is large enough, but the planter who operates on a larger scale will find a barrel sprayer—with 15 to 20 meters of 13-millimeter rubber hose attached, mounted on wheels—the most convenient. The "Vermorel" nozzle is preferable to other types of nozzles. If a knapsack or compressed-air sprayer is not obtainable, an ordinary bucket pump to which a hose with spray nozzle is attached, can be used.

It is important that the spraying mixture be well strained so as to prevent the nozzle from becoming clogged in the act of spraying.

A fungicide or contact spray may also be rendered effective against biting insects by adding to them Paris green or arsenate of lead. These poisons should then be added to the spray already mixed as if this were pure water and in the proportions recommended under formulas 4 and 6.

Always remember that the copper sulphate and the arsenates are very poisonous and should not be left where they are accessible to children or domestic animals.

FORMULAS FOR FUNGICIDES AND INSECTICIDES.

1. BORDEAUX MIXTURE.

For fungi.

Copper sulphate	kilograms	1.5
Unslaked lime	do	1
Water	liters	100

Place the copper sulphate in a feed sack and suspend it in a barrel containing 50 liters of water so that the sack is just covered by the water. Slake the lime in another vessel by adding a little water at a time, and when slaked, dilute to 50 liters. Before mixing stir the two solutions thoroughly. Then dip a bucket from each solution and pour the two liquids together in the spray barrel, at the same time agitating the mixture vigorously. An excess of copper sulphate is injurious to the foliage, and before spraying the mixture should therefore be tested. This is done by inserting and holding in the mixture a clean steel blade for one or two minutes. If copper is deposited on the blade, more lime must be added. Use the mixture at once.

2. KEROSENE EMULSION.

For scale and other sucking insects.

Kerosene	liters	7.5
Hard soap	kilogram	0.25
Water	liters	4

Dissolve the soap in boiling water and while still very hot add the kerosene. Churn the hot liquid steadily for fifteen or twenty minutes by using a force pump, the liquid being sprayed back into the vessel until it is emulsified. Sufficient hot water should be added to increase the solution to 16 liters. For spraying dilute at the rate of from 1 to 3 liters of the emulsion to 15 liters of water.

3. SELF-BOILED LIME-SULPHUR WASH.

For fungi and scale.

Quicklime	kilograms	3
Sulphur (flour of sulphur)	do	3
Water	liters	100

Place the lime in a barrel and pour on enough water to cover it. When the lime begins to slake, add the sulphur after running it through a sieve to break the lumps. Stir the mixture constantly and add water as needed to form a thick paste at first, and then gradually a thin paste. The lime will supply enough heat to boil the mixture several minutes. As soon as the lime

is well slaked add water to cool the mixture and prevent further cooking. Strain carefully, working the sulphur through the strainer, and dilute to 100 liters. *This spray is at the same time effective against fungi and scale.*

4. PARIS GREEN.

For biting insects.

Paris green	grams	60 to 120
Quicklime	kilogram	0.5 to 1
Water	liters	100

Place the lime in a wooden vessel and slake, dilute to 100 liters, and add Paris green. London purple may be substituted for Paris green and used at the same rate. Both these poisons, particularly the Paris green, have a tendency to settle and the liquid should be kept in constant agitation during the spraying, else the spray from the bottom of the barrel may seriously damage the foliage while the rest is useless.

5. PARIS GREEN.

For biting insects.

Paris green	grams	25
Air-slaked lime	kilogram	1

Mix the two ingredients thoroughly and place the mixture in a bag of cotton cloth and shake it over the plants until they are covered with a thin layer of dust. This formula is especially recommended for vegetables. The mixture should be applied to the plants in the morning while the plants are still wet with dew. If the lime is not obtainable flour or fine road dust may be used as substitutes.

6. ARSENATE OF LEAD.

For biting insects.

Arsenate of lead	kilogram	0.5 to 1
Quicklime	do	0.5 to 1
Water	liters	100

Slake the lime in a wooden vessel, dilute to 100 liters and dissolve the arsenate of lead in the liquid. Like the Paris green the arsenate of lead settles to the bottom of the vessel and the mixture should therefore be kept constantly agitated during the spraying.

Among the sprays for biting insects, formula 6 is taking the lead in preference to Paris green and is one of the most effective and economic sprays of the present day.

7. THE MALLY FRUIT FLY REMEDY.

Arsenate of lead	kilogram	0.6
Sugar	kilograms	7.5
Water	liters	100

Dissolve the arsenate of lead in a small quantity of water, dilute to 100 liters and add the sugar.

This formula is recommended to the mango growers in the Philippines as a remedy for the mango fruit fly. The spray should be applied to the foliage and never so heavily that it drops to the ground from the trees. The application of this spray should be supplemented by the gathering and burning of all immature fruits that fall from the tree, or they may be disposed of by burying them not less than 30 centimeters deep, or by feeding them to hogs.

8. TOBACCO DUST.

For aphis.

Cucumbers, watermelons, eggplants, etc., are frequently attacked by small, green or black sucking insects, commonly called "green flies" or "plant lice". These insects, while they may also be destroyed by contact sprays, are best kept in control by the use of tobacco dust. Apply the tobacco dust liberally to the plants wherever these insects appear.

O. W. BARRETT,
Chief, Division of Experiment Stations.

Approved:
F. W. TAYLOR,
Director of Agriculture.

YAMS.

By O. W. Barrett,
Chief, Division of Experiment Stations.

It would be fairly easy to name the five most important food plants of the world but the second five would be a much more difficult matter to decide upon. The true place of the yams in the world's list of economic plants is a debatable matter, but for the sake of argument we may regard them as holding about fifth place. It must be remembered in this connection that outside of Europe and North America nearly all the inhabitants of the earth's surface are either in China or in the Tropics, and while China makes use of but one or two varieties of yams, both the Old and the New World Tropics depend to a very large extent upon this root-crop as a food supply throughout the greater part of the year.

On account of the habit of the plant itself, the methods of culture, storage, and sale, yams are not prominently in evidence and consequently many travelers, and even residents in countries like India or the West Indies, do not appreciate, and in many cases it seems, do not even know the important rôle of this crop. For instance, in Porto Rico, where yams rank as the second most important root-crop, they are seldom used by the American families unless the family in question has resided there for several years; in fact, it is a common case for the housewife to purchase third-class and almost inedible potatoes at from 30 to 40 centavos a kilo, when close by the side of the potatoes there are heaps of excellent yams, offered at about 10 centavos a kilo. Probably the rough, coarse appearance of yams accounts, in part, for this lack of popular favor which is so evident among European and American residents in the Tropics.

It is certain, however, that the yam is one of the very oldest cultivated root-crops, having been grown in India for many centuries; it was also an important crop of the aborigines of Tropical America when the early Spanish navigators entered that region. In fact, it would seem that yams vie with the sweet

potato, the taro, and the yautia for antiquity in point of cultivation by man,—all these food plants having been under domestication so long that they seldom or never produce seeds. Some species of yams do, however, on very rare occasions produce flower clusters and a few of the domesticated species undoubtedly produce viable seeds under favorable conditions. The yams have broken the regulations, so to speak, for plant reproduction in two ways: A number of varieties commonly produce small, or in the case of the air-potato, large tubers in the axils of the leaves (a rather rare infraction of the law); furthermore they all (?) possess the trait of sending sprouts from almost any part of the surface of the tuber-like root, which, however, is not very uncommon in the plant world.

Botanically the yam family is rather closely related to the smilax and the lily families, yet for certain reasons it stands alone in a class by itself. There are supposed to be only about 160 species in the family, which consists of some eight or nine distinct genera, but practically the entire family depends upon the genus *Dioscorea* which comprises about 150 botanical species. Of these 150, only some ten or twelve species are important in the world's food supply list and probably three-fourths of the cultivated varieties are included under not more than five or six species; however the actual number of distinct *varieties* and named sorts comprised under these few species is unknown. For some reason both the economic and the taxonomic botanists have neglected this most interesting group of plants; specimen sheets showing only leaves are not desired by the herbarium student and it appears that no collection which could in any way boast of being fairly complete has ever been made, either in the Western or Eastern Hemisphere. The writer once grew a collection of about 25 kinds, nearly all of which were of West Indian origin. It is probable that the Pacific archipelago and the East Indies, Philippines, India, and tropical America each possess a considerable number of endemic varieties and it is quite possible there are 100 distinct forms of the true yams in cultivation at the present day.

Most yams have peculiar leaves, with 3, 5, or 7 midribs instead of one as in most other plants. The leaves are frequently leathery and shining; insect pests seem unable to injure them.

While nearly all the yams are twining or climbing plants, a few, like the "Mapues" varieties of the West Indies, can be grown without artificial supports of any kind. Some varieties attain a height in six months of 20, or even 30 meters. A few varieties like the "Yampee" (*Dioscorea trifida*) are almost un-

branched; that is, the root send up two or three stems which grow principally at the tip without producing many side branches; others, like the "Water" yams (*D. alata*) throw out a vast number of side branches, a single plant being able to cover a surprisingly large area with its luxuriant but weak foliage. Some varieties have strong woody stem which may attain a diameter of 3 or 4 centimeters, while others produce only slender herbaceous stems. Many varieties are armed with strong prickles, and, in a few cases, even the roots bear such defensive spines that the harvester must remember to never put his hands into the hill in digging out the roots.

The flower clusters, when produced, are usually a raceme, or spike. The seed from these, in some varieties at least, is winged to enable it to be carried by the wind. The roots, sometimes called tubers, but always incorrectly, have no "eyes" whatever. While filled with a starchy substance like the potato and cassava, they are usually covered with a more or less thick rough bark; a few of the Philippine varieties are clothed only by a thin integument resembling that of the ordinary potato. In most varieties the root is irregularly cylindrical but may be of almost any shape; in fact, the shape of the root and the color of its integuments (for there is a true, usually colored skin beneath the coarse outer bark) serve to distinguish the closely related varieties which may be apparently identical as to foliage and habits of growth. In India a few kinds (the *D. globosa*) are nearly spherical. Some kinds produce a dozen or more finger-like roots, more or less attached at their bases to the foot of each stem. Some, like the Chinese yam, which is said to be native to the Philippines, have very long and slender roots; this feature renders their cultivation extremely difficult, although their quality may be excellent. One of the wild yams of Porto Rico has roots scarcely ever more than 3 centimeters in diameter, but of indefinite length; the quality is so fine, however, that the natives frequently forsake their fields of sweet potatoes, yautias, and even ordinary yams, to dig for this wild inhabitant of the jungle.

The weight of the edible roots of the yam plant of course varies with the variety, the cultivation given it, and the season, soil, etc. While one-half kilo may be considered a fair yield for the very high-priced "Mapues," and 2 kilos a heavy yield for the delicious "Yampee," some of the "Water" yams may give 10, or even 25 kilos. The world's record for a yam root was probably attained in the State of Florida, United States of America, a few years ago when one plant gave some 60 kilos

of edible root, though this was probably the result of two seasons' growth. Ordinarily six or eight months suffice to mature roots of the principal cultivated varieties; a few can reach maturity in five months, while some wild forms require at least twelve, and probably in many cases, twenty or more months to reach their maximum size.

In planting yam roots only the basal, or upper portion, is customarily used; under favorable conditions even the tip of the yam root can be made to throw sprouts, but it is usually a waste of materials to plant the distal half of any ordinary yam. Sections or chunks of the cylindrical rooted varieties weighing from 40 to 100 grams are regularly used in planting; if the whole tuber is planted, especially if it weigh more than one kilo, decay may set in from some external injury, and before the sprouts could develop sufficiently to resist the attack, all of the material might be consumed.

In its habits of sprouting the ordinary yam closely resembles the sweet potato, which also is not a tuber, but a root. The sprouts, which from their uncommon origin are called adventitious, may arise from any point on the surface of the root, though the tendency is confined largely to the basal half. In this connection it may be remarked that the cassava, which also stores up starch in a true root, cannot be induced to send out sprouts from even the basal end of the root.

Unlike most other root crops, growing yams have a pronounced faculty of being able to resist drought and the roots after harvesting may be kept for months in a very dry atmosphere without injuring their viability in the least; in fact, in some countries the roots, or the portions of them to be used for planting, are hung up in the shade, sometimes in the roof of the dwelling house, and at the proper time for planting the roots begin to send out reddish or purplish shoots, thus advising the planter of the fact that they consider it time to begin another season's work, so to speak. The drought-resisting habit of tender-leaved plants like the "Water" yams is rather difficult to understand, since it appears that there is no special physiological or anatomical arrangement in the leaf surface or stem of the plant to prevent evaporation of sap. The writer has noticed in East Africa yam plants in thriving condition with no indication whatever of wilting during a prolonged drought when all other crops and most of the native plants were practically dried up. This is still more strange because the yam plant has no taproot and only a very moderate number of feeding roots; moreover, these latter do not seem to penetrate deeply.

as might be expected, into the water-bearing strata of the soil.

Among the numerous characteristics of the yams which render this crop of plants worthy of special study and put them in a sort of class by themselves in plant societies, is the probably constant feature of possessing in the raw state a poisonous substance known as dioscorein; this little-known vegetable alkaloid has powerful effects upon animals or man even when eaten in small quantities. Were it not for this fact the wild yams would probably soon be exterminated on acount of the eagerness with which the roots would be sought after by wild pigs and other forest animals; it is said that even poultry instinctively recognize the dangerous nature of raw yam roots and refuse to touch them until cooked. Some yams possess a peculiar, rather sickening odor, while others have only a starchy smell like that of a potato. All yams appear to have, in addition to the starch, a gummy or mucilaginous substance which is probably of a harmless nature. On account of this gummy material, yams can never be used as starch producers for the reason that the gum prevents the settling of the starch grains when the root is ground and mixed with water; neither salt nor acids appear to be able to "cut" this gum and therefore a mixture of ground yam and water will ferment before settling. Upon cooking, however, all traces of the alkaloid disappear and the gum itself is broken up so that at least in the case of the principal yams—even some of the "Water" type—they become "mealy" like the very best potatoes. Perhaps the whitest of all root crops when cooked is the common "Tugue," a variety of yam which has recently come to our notice and which appears to be confined to certain districts in Luzon; its white fecula is brilliant and without the creamy tinge that most potatoes have. A few yams, even when baked, still remain somewhat watery, or at least pasty. The size of the starch granule does not appear to vary greatly in the different kinds of yams; it is of moderate size and somewhat resembles the cassava granule.

The color of the fecula, or starchy matter of the root, varies from snow white to a dull purplish black; many varieties are simply tinged with reddish or purple, but probably 75 per cent of the total number are creamy white inside with an inner bark of some other shade, such as pink, purple, yellow, etc. There is a wide range of aroma in the cooked roots; one of the common Philippine yams when baked has a pronounced odor like that of fresh raspberries. In 1907 this variety was introduced into the United States by Mr. William S. Lyon and the writer.

Much has been written about the "air-potato" but this yam

deserves very little attention by the practical agriculturist. Its axillary tubers, sometimes weighing up to 500 grams, are so bitter that unless specially treated by lime juice and by soaking in water before cooking they are hardly edible. This species (*D. bulbifera*) is an exception to the rule that all yams produce edible rootstocks. The potato-like tubers, which are borne in the axils of the leaves, are of an almost indescribable shape,—roughly three-angled, convex on one side, and sometimes with the angles more or less notched or toothed. Some species of yams, like the Hawaiian, may reproduce themselves by small axillary tuberous roots, while under certain conditions the "Water" yam group may have a small number of axillary tubers, or adventitious tuber-like roots, of very variable sizes and shapes, but always covered with a coarse strong bark like that of the true rootstock. These above-ground tubers and tuberous roots may be used for propagation and are especially useful in shipping by mail, since they will ordinarily endure four to eight months without moisture. It is a question whether these small resting buds would produce as great yields as would the ordinary rootstocks or sections thereof.

On account of the tendency on the part of the larger growing types of yams to bury the main roots to a depth of 50 or even 80 centimeters below the soil surface, it is customary to plant the cuttings, or "root heads" on top of a mound of earth; this is possible because of the utter disregard of the young yam plant for moisture. While every other plant, except perhaps the cacti, would be dried out before the feeding roots could get down into the moist soil, this high-hilling style of planting does no harm to the yams. A system recommended for planting the Porto Rico yams, and which is believed to be the best for large plants or plantations, is the following: A deep trench is made by plowing, either with a middle-breaker plow or by running an ordinary plow in opposite directions in one furrow and then removing the loose earth in the furrow by means of a spade; this furrow now being 25 to 40 centimeters deep is filled in with layers of grass, weeds, leaves, etc., and earth alternately, each layer being from 10 to 15 centimeters thick. When this operation is completed, all the loose earth on each side of the trench being brought up, there will be formed a ridge over the trench; at the time of setting the "heads" this ridge will have settled somewhat and it should then be elevated by taking up the earth on each side until some 8 to 12 centimeters of earth are left on top of the heads which should be some 20 to 30 centimeters above the normal soil surface.

The heads may be set from 30 to 60 centimeters apart in the case of the smaller growing varieties, and 50 to 100 centimeters apart in the case of the larger sorts. The trenches, or rather ridges, should be from 60 to 120 centimeters apart, depending upon the variety, soil, etc. The trench must always be drained since yams are intolerant of any stagnant water. In case of a sloping surface the trenches should run parallel with the slope, so that no rain water may collect between the ridges. This system greatly facilitates digging the deep-rooting sorts and apparently enables the yam root to strike downward without the tremendous opposition exerted against it by the firm soil, which would be the objectionable feature under the ordinary method of planting. Furthermore, the decaying of the vegetable matter furnishes plant food to the roots, holds moisture for the deep roots, and, probably more important still, permits perfect ventilation around the rootstock and feeding roots.

Most varieties require poling; that is, the long weak mass of vines must be kept up off the soil on supports, trellises, or something of the sort. This system of supports not only offers a larger surface to the light, but prevents fungus diseases from attacking the leaves and stems. In this connection it may be said that yams are singularly free from either insect or fungus attacks, though certain rots, probably bacterial in nature, attack the rootstock through wounds in the surface.

In localities where winds are strong the poles or trellises must, of course, be well braced to prevent blowing over, since the heavy growth of vine on the pole acts like a sail and takes the full force of the wind.

Yams may be cooked in the same way as potatoes, or sweet potatoes. Some varieties are preferable baked, while others seem better boiled. A favorite dish in some countries is made by boiling roots until nearly "done", then slicing and frying in coconut or olive oil. Yam cakes, made by mashing the boiled or baked roots, then adding milk, or cream, butter, eggs, and cheese, and then frying, are excellent. Puddings can, of course, be made, as is done with sweet potatoes. Yam flour, made by grinding the dried slices of either raw or partially cooked roots, can be made into a variety of dishes; unfortunately there is a trace of tannin in most yam roots and this usually discolors the slices if in contact with any metal; in fact, it would appear that there is a peculiar substance in the white yams which turns the whole fecula surface brownish within a few hours after exposure to the atmosphere. Flour made from the black, purple, and red varieties is, of course, somewhat objectionable to ortho-

dox housekeepers, but it is interesting in its uniqueness and the flavor is surprisingly good, especially if during the drying process the slices have neither been scorched nor tainted with metallic compounds.

Unfortunately the word yam is commonly applied to several varieties of sweet potatoes in the Southern United States, and although authorities differ widely as to which varieties of the sweet potatoes this erroneous term applies, the word has become so popular in some districts of the south and southeastern United States that it will take many years to eradicate the mistake. About the only resemblance or relationship between yams and sweet potatoes is based upon the fact that both happen to be root crops and grow from "vines."

In the Philippines there is a deplorable lack of appreciation for the yams as a crop, and though a few varieties are cultivated in certain districts, it will probably be a long time before the markets will offer to the public a constant supply of first-class roots. There are probably several sorts native to the Philippines which are not found elsewhere, one of which, the small white Tugue of Luzon, bids fair to become a very high-priced, if not famous edible article. Several of the better Tropical American sorts are being introduced and gradually the public will come to demand something besides imported potatoes and second-class native sweet potatoes in the line of Philippine root-crops.

There is undoubtedly a good field here for the earnest planter in the study of yam problems,—not alone for his own table but also as a commercial enterprise.

a

b

PLATE II.—(*a*) COMMON TUGUE FROM BATANGAS. (*b*) YAM OF THE LIMALIMA TYPE.

TESTS OF ANTIRINDERPEST SERUM.

By

ARCHIBALD R. WARD, B. S. A., D. V. M.,
Chief Veterinarian,

AND

FREDERICK WILLAN WOOD, D. V. M.,
Acting Assistant Chief Veterinarian.

The introduction of antirinderpest serum has exerted a profound influence on methods of combating rinderpest. It has been employed extensively in the more civilized countries where the disease exists to-day. The literature shows widely differing statements concerning the precise method of using serum in combating rinderpest, and its usefulness. This fact and the results of its use in the Philippines seemed to warrant further investigation of the effect attained by the use of serum, particularly by the use of serum alone.

Serum has been used in combating rinderpest in various parts of the world with different objects in view. In India it is injected into animals which are immediately exposed to the disease by contact with infected animals which results in their contracting the disease and passing through an attack, the severity of which has been modified by the serum. In other places serum has been used with the idea that it would absolutely protect the animal from attack during a certain period, generally stated by writers on the subject to be from two to four months in duration.

In addition to the use of serum alone for the purpose of accomplishing benefit in the two ways mentioned before, injections of serum have been employed simultaneously with injections of the blood of a sick animal which is capable of transmitting the disease. The result of this simultaneous inoculation, as it is termed, is an attack of rinderpest in the injected animal, varying in severity according to the amount of serum used and the care given the infected animal, and resulting in a permanent immunity.

Serum has been extensively used in parts of Africa and in

the Philippines with the expectation of conferring to the animals injected with the serum an absolute immunity against attack.

Here in the Philippines, besides injecting serum, effort was made to discover and isolate infected animals so that the spread of the disease might be prevented. The results of the use of serum in the field were not such as to confirm the belief that animals injected with serum were protected against attack for any period whatsoever. Sickness and even death have occurred with disturbing frequency within two weeks after injection. In the early days the dose employed was 50 cubic centimeters per 100 kilos, which dose was frequently doubled in the effort to obtain the results desired.

The whole theory of preventing attack of rinderpest by the use of serum seemed to us to rest upon a very insecure foundation of evidence by experiments, and in view of the results obtained in the field, it seemed highly desirable to conduct in the Philippines a series of tests designed to throw light upon the value of serum in combating rinderpest.

An extensive series of tests have been conducted, the results of which will appear elsewhere in complete detail. Various considerations limit the present article to a bare enumeration of the kind of tests conducted and the conclusions drawn therefrom.

Experiment No. 1.—Fifteen Batanese cattle were injected with doses of 20, 35, and 50 cubic centimeters per 100 kilos bodyweight and were immediately thereafter exposed to the disease along with the others to serve for the purpose of comparison with the animals which received the various doses of serum. The animals injected with serum came down with the disease within a very few days from the time of the appearance of the disease in the animals which received no serum. The results were very striking, since the conditions of the experiment were such that absolute protection from attack might have been expected to exist for several months.

Experiment No. 2.—The experiment was conducted with twenty carabaos and was planned to duplicate Experiment No. 1 in every respect, but exposure was accidentally deferred for about a week, a matter of no consequence to the experiment. The animals, whether injected or not, all displayed symptoms of the disease at or about the same time, which demonstrated that serum had not postponed attack.

Experiment No. 3.—Serum prepared from immune cattle and that from susceptible animals both failed to defer appearance of symptoms in cattle more than a few days. The character of the disease was much milder in animals receiving serum from animals originally susceptible.

Experiment No. 4.—Serum from cattle injected into cattle in doses of 50, 75, and 100 cubic centimeters per 100 kilos every five days did not defer attack to any significant extent although the character of the course of the disease was modified.

Experiment No. 5.—Infection of exposed animals was not prevented by doses of from 10 to 100 cubic centimeters injected at various intervals of from one to seven days. Appearance of symptoms was delayed but slightly. The character of the disease was profoundly modified, especially in the matter of temperature.

Experiment No. 6.—Simultaneous inoculation was performed, using 190 cubic centimeters for animals varying in weight from 222 to 290 kilos, with a loss of 15 per cent.

Experiment No. 7.—Simultaneous inoculation was performed on a group of animals weighing from 232 to 300 kilos, using 290 cubic centimeters of serum each, with no loss.

The results are most striking when compared with those of the previous experiment in showing the effect of variation in dose of serum upon the severity of the disease. The larger dose in this experiment eliminated all symptoms but temperature in all cases, and in seven animals temperature did not exceed 39° C.

Experiment No. 8.—Comparison of serum from the *Institut Pasteur de Nha-Trang,* Indo-China, with ours showed no striking difference in character.

Experiment No. 9.—A similar comparison of our serum with that prepared at the experiment station for animal diseases, Tokyo, Japan, showed that our serum is similar in character to that prepared in Japan.

Experiment No. 10.—In general the experiment showed that the longer the delay between injection and exposure to infection, the more severe the attack. The inference is that antirinderpest serum is rapidly eliminated from the system. Holmes in India has shown this better by a nicer graduation of dosage.

Experiment No. 11.—Injection of serum alone in doses of 80, 100, and 200 cubic centimeters in the absence of exposure to rinderpest infection caused an immediate rise of 1° in temperature.

GENERAL CONCLUSIONS.

The foregoing experiments seem to show that antirinderpest serum does not prevent infection with rinderpest. On the contrary, animals injected with serum and exposed to rinderpest soon contract the disease and pass through a more or less modified attack. We have shown that the blood of animals is infective during this attack.

BEARINGS OF RESULTS UPON METHODS OF COMBATING RINDERPEST.

Our conclusions indicate the inadvisability of relying upon serum to prevent attack as advocated by writers using this method in various parts of Africa.

Formerly in the Philippines serum was undoubtedly used with the idea that it would absolutely protect against attack, although quarantine and sanitation were enforced to some degree.

When the use of serum alone is combined with sanitary measures with the object of eradicating the disease, the amount of success is dependent upon the efficiency of the sanitary factor. Such a practice involves the combination of methods that are inconsistent. If serum protects against infection, no quarantine is needed to protect the injected animals. If serum does not protect against attack, the spread of the disease is not checked by serum and on the other hand quarantine will accomplish the desired result. Another objection to such a combination consists of the fact that when injected animals are protected from infection by quarantine or similar measures, they miss the opportunity of passing through an immunizing attack during the period that the serum is still effective. On the contrary if injected animals do contract rinderpest the cases are not easily recognizable and such animals spread infection, where, if serum had not been used, the cases would have been recognized.

Under such conditions the use of serum is superfluous, expensive, and, by disguising cases, increases the difficulties of a campaign of sanitation. If in spite of these objections it is considered advisable to use serum, it must be recognized that injections of all susceptible animals must be repeated at frequent intervals, involving a prohibitive expense.

If serum possesses a curative value its use might be justified, but our results do not warrant such a belief.

The use of serum alone with measures to induce infection is undoubtedly useful as a palliative measure as practiced on the plains of India among highly resistant cattle. There the character of the population, nature of the country, and the magnitude of the task utterly prevent maintaining an effective quarantine. The susceptibility of the cattle and of most of the carabao in the Philippines is such as not to warrant attempting to use this method, especially as efficient quarantine may be maintained.

Our results have led us to the conclusion that simultaneous inoculation under the very best surroundings and care may be successfully practiced upon cattle in the Philippines. Our experience with carabaos as shown in Experiment No. 2 does not

justify us in expecting serum to modify the disease in carabaos so profoundly or as uniformly as in cattle. Some years ago this method was attempted as a field measure in the Philippines but was soon abandoned on account of the serious opposition of stock owners.

We have not been able to ascertain that simultaneous inoculation is anywhere generally practiced in the field except perhaps in Russia. Writers in the Trasvaal, toward the end of the outbreak, apparently did not recommend its employment. Theiler points out the danger from the various blood parasites that may be transmitted by this process.

Arloing, in describing its use in Egypt, states that simultaneous inoculation had to be abandoned in Egypt because a panic took possession of the cattle owners.

In India the application of simultaneous inoculation to a number of susceptible Australian cattle led to disastrous results. A committee of investigation brought out the fact that this method is not generally employed there outside of laboratories. They recommended that as an act of grace the cattle owners be compensated for the loss of their stock.

There are many obstacles and objections to be considered in connection with the employment of simultaneous inoculation as a field measure. Among these are objections of owners to surrendering custody of animals, expense of providing sheds, labor and professional force, cost of indemnity for losses, magnitude of task, and danger of simultaneous inoculation stations as foci of infection. There may be grave danger also of fatal complications from pregnancy, piroplasmosis, trypanosomiasis, foot-and-mouth disease, anthrax, and hemorrhagic septicemia.

Notwithstanding our success with cattle under experimental conditions we do not feel justified in instituting a campaign of simultaneous inoculation as a field measure in combating rinderpest in the Philippines.

It is not our intention to discuss the methods and results of quarantine and sanitation, other than to note that these measures are now being relied upon exclusively in the Philippines.

THE EMBRYONY OF THE MANGO.

By P. J. WESTER, *Horticulturist.*

The seeds of most plants are always monoembryonic, *i. e.*, each seed produces only one plant, though in some plants like the orange (*Citrus aurantium* L.), the tangerine (*Citrus nobilis* Lour.) and the yambo (*Eugenia jambos* L.) the seeds are also frequently polyembryonic; in these species one seed may contain several embryos, each of which, under favorable conditions, is capable of producing a plant. The mango (*Mangifera indica* L.) is both mono- and polyembryonic, the seeds of the latter type frequently producing six to eight plants, and as many as thirty have been observed to spring from one seed. (Plate III.)

In the study of polyembryony of the citrus, it was found:

> That the embryos, other than those developed from the fecundated egg-cell, are derived from certain cells of the nucellus, lying near the embryosac wall, which become specialized, grow and develop rapidly and form a tissue mass which pushes out into the embryo and produces an embryo similar to that formed in the normal way from the egg-cell. The embryos formed in this way were called by Strasburger, the investigator, "adventive." If we correctly understand the action of fecundation, it is clear that in this group only those that develop from the egg-cell proper as a result of the fecundation would show indications of hybridization; since the adventive embryos develop from the mother tissue, in these we should not expect to see any of the characters of the male parent.[1]

The validity of this theory by Webber and Swingle was fully proved and strikingly demonstrated before the fruiting of the seedlings in the course of their work in hybridizing the orange and *Citrus trifoliata* L., the leaf characters of the parents being so distinct (the orange being unifoliate and the other parent trifoliate) that the respective characteristics were easily recognized in the hybrids. In some instances where several seedlings developed from one seed, one was found to be a true hybrid and the remaining plants false hybrids, or exhibiting the characters of the mother plant only.

As far as the writer is aware the polyembryony of the mango

[1] Webber, H. J. and Swingle, W. T., Yearbook U. S. D. A., 1904, p. 22.

seed was earliest discussed at some length by Reinwardt nearly a century ago.[1]

In fact, Gaertner had already noted the peculiar structure of the mango seed, but he was probably not aware of its significance. Reinwardts' paper was accompanied by a colored plate illustrating the polyembryonic character of the seed and he also mentions the occurrence of monoembryony among the cultivated varieties. Later references to the polyembryony of the mango have been made by Schacht.,[2] Strasburger,[3] and Cook,[4] but the monoembryonic character of the seed of this species seems to have been lost sight of, or at least, no importance attached to this feature.

In Florida the observation has been made that the seedling types, all being polyembryonic, transmit their characters to their progeny in a remarkable degree, *i. e.*, "come true to seed." Of course, variation exists but the main characters of a type are well reproduced. This feature of "reproduction of type" of the inferior seedling varieties has also been noted in Jamaica; this is contrary to the habit of the imported grafted varieties from India, whose progeny is variable.[5]

The types grown in the Philippines, popularly but incorrectly called varieties, are well known to reproduce themselves true to seed, and, as the writer has had the opportunity to ascertain in the examination of fruits from a large number of trees, there is, in the botanical characters of the tree, the form of the fruit, the color and texture of the skin, the color, texture, flavor, aroma, and presence of fiber in the flesh and the shape of the seed in the individual trees of the different types, a uniformity of general characteristics that is truly striking. The absence of mangos exhibiting the combined characters of two types, as far as noted by the writer, is very remarkable. Were the characters above referred to the only features to be considered in a fruit tree there would be ample justification for setting out seedling mango orchards of the two best of these types, the Carabao and the Pico. On the other hand, all seeds of the grafted mango varieties introduced into Florida from India, except Cambodiana, that have come to the attention of the writer, have proved to be monoembryonic; of the Mulgoba seedlings that have fruited there, none have retained the characters

[1] Acad. caes. leop. carol. nova acta, 1825, Vol. XII: pp. 343–346.

[2] Madeira and Tenerife, 1859, p. 53.

[3] Jenaische Zeitsch. d. Naturwiss, 1878, Vol. XII: pp. 652–657.

[4] Torreya, 1907, Vol. VII: No. 6, pp. 115–116.

[5] Bul. Bot. Dept. Jamaica, 1901, Vol. XIII, p. 165.

of the mother parent to the degree that the seedling polyembryonic types do. The statement made by C. Maries from India, that "If the seed from the best and finest sorts are planted, the chances are that fifty per cent will be as good as the fruit planted, a few better, and the rest worse,"[1] would seem to indicate that perhaps most if not all the East Indian grafted mangos are monoembryonic. It is significant that the only variety introduced into Florida from the East that is said to reproduce itself from seed, the Cambodiana, from Saigon, is polyembryonic.

A most interesting account of an investigation on the formation of the embryo in the mango is found in the report of the Florida agricultural experiment station for 1908, pages 109 to 125, accompanied by several illustrations. Belling, the investigator, in an examination of fruits from two trees of a seedling type (polyembryonic) in Florida, discovered no formation of embryos from the egg-cells in the ovaries and all the embryos seen were adventive. He also notes the coincidence of monoembryony in the grafted varieties seen by him, but seems to think that this is the result of grafting for several generations rather than an inherent botanical character in these varieties.

Though well aware of the desirability of having more material for study than has been available before reaching a definite conclusion on the subject, the writer, from the data collected, ventures nevertheless to advance the theory that the species *Mangifera indica* L. may be divided into two great types: One, the monoembryonic, to which belong most, if not all, of the mango varieties in India; the other, the polyembryonic type, the mangos belonging to which transmit their characters to their progeny. To the latter type belong the mangos of the Philippine Archipelago, the Manila of Mexico, the seedling types that are cultivated in Florida, and perhaps those in most other parts of the Tropics. The Cambodiana also belongs to this group; in fact there are so many similarities between the Cambodiana, the Mexican Manila, and the Carabao type of mangos grown in the Philippines that it is not difficult to believe that the one has sprung from the other, or else that they are of common parentage.

The writer is indebted to Mr. D. G. Fairchild, Bureau of Plant Industry, United States Department of Agriculture, for the photograph accompanying the paper.

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[1] Watt, G., Dictionary of Economic Products of India, 1891, Vol. V: p. 148.

PLATE III.—MANGO SEEDLING, ILLUSTRATING POLYEMBRYONY.
(From negative owned by the United States Department of Agriculture.)

SOME SWINE FEEDS FOR THE PHILIPPINES.

By C. W. EDWARDS, *Agricultural Inspector.*

Swine raising is an industry found very generally throughout the Philippine Islands, for, unlike many other branches of agriculture, it does not necessitate a large outlay of capital and quick returns are realized. It is within the means of every Filipino farmer to produce and market each year a few hogs. The question then arises, are the present methods of production, under existing conditions, conducive to the largest returns, and, if not, in what way may they be improved upon?

Under the present system of management, aside from that employed by a few of the more up-to-date growers, the hogs are allowed to run at will and forage a greater part of their subsistence, practically the only feeds fed being tiqui tiqui and sliced banana stalks. While this method does not involve much expense the gains are slow and small and there is no doubt but that it is within the means of every farmer to improve upon it in such a manner as to increase his yearly profits very materially. The two principal lines of improvement are the up-grading of the native stock by selection and crossing, and the growing and feeding of more and better feeds. The former is a longer process than the latter and is not within the immediate means of every grower. However, regarding the latter, there are a number of forage, grain and root crops, one or more of which is within the reach of every farmer, that are known to be adapted to the country and can be marketed profitably in the form of pork.

The present commonly used feeds, tiqui tiqui and banana stalks, are of a very low nutrive value, being mostly cellulose. They are too bulky when fed alone, though the former can be combined to advantage with some of the more concentrated feeds.

Corn properly ranks first among the grains adapted to swine production, and is grown in every province of the Islands. It is utilized in the United States as a swine feed more extensively than any other grain, being often fed as an entire ration. Better results, however, are obtained when it is fed in conjunction with other feeds which contain more protein. In some

cases in this country where the yield per hectare is very low a more economical crop could perhaps be grown, but if proper attention were given to seed selection, preparation of soil, planting, and cultivation, corn growing could soon be placed on a profitable basis with respect to swine breeding, bearing in mind the value of the fodder produced which may be fed to other farm animals.

In this article it is not the intention to go into detail as to the methods of cultivation, etc., of these crops, and these points will only be touched upon in a general manner. At harvest time seed should be selected for the next year's crop; good-sized, well-shaped ears should be taken from the largest stalks, hung in a protected place, and allowed to dry. Near planting time a few kernels should be shelled from each ear and their power of germination determined. From those showing the highest percentage of germination should be selected the seed for planting. Too close planting is a common error. Proper distance depends upon the soil, season, and variety. In rich soil having ample rainfall planting in hills (two kernels to the hill) 30 centimeters apart in rows 1½ meters apart has been advocated, but on ordinary soil this is too close and 1 meter each way in hills of three kernels is a safer distance. Cultivation should be deep at first and more shallow and frequent as the crop nears maturity. Many experiments have been made to determine the most advantageous method of feeding the corn crop. Many farmers of the so-called corn belt of the United States practice the plan of "hogging off," as opposed to yard feeding. By "hogging off" is meant the turning of hogs into a field of standing corn and allowing them to pull down the stalks and consume the corn at will. The arguments in favor of this method advanced by many growers are, first, the saving of time and labor in harvesting; second, pork may be produced with less grain than by feeding ear corn; third, the cost of fencing is less per hectare than the cost of husking; and fourth, there is no more waste of the corn than when fed in the yards.

In this country such a procedure would perhaps prove satisfactory only in localities where labor is scarce and bamboo for fencing material is plentiful. Under such conditions fields could be divided into lots by portable or permanent fences. The lots should not be too large, as the hogs should not be turned into more corn than they can dispose of within three weeks during the dry season, or two weeks during the rainy period. No doubt the best results for the average farmer will be realized by using the corn in conjunction with other feeds.

Kafir corn has been grown extensively in a number of the provinces. On fairly good soil a large amount of grain (seed) and forage are produced. These seeds compare favorably in feeding value with corn; however, the crop is considered secondary to the common maize.

Most growers realize that to attain the best results ample pasturage should be available. Nevertheless in this country the question of fencing must be considered, and under certain conditions the practice of utilizing pastures for swine producing may be impracticable; certain forage crops, however, can be disposed of so advantageously by this method that in many instances this plan might be followed very profitably. Among the most important crops of this class are peanuts and chufas. Peanuts are now grown to some extent in the majority of the provinces but very seldom are they considered as swine feed, the nuts being used as a human food and the tops as forage for horses and cattle. In many tropical countries this tuber is considered a very valuable hog feed. It may be utilized as a pasture or as a grain crop, the fruits being harvested and fed with other feeds, and the tops dried and stacked to be used later as hay. The nuts are high in protein content making them a valuable component when used in a mixed ration with tiqui tiqui and corn. The most profitable method, however, is to utilize the plant for pasture purposes, since in this way the animals consume the green forage so necessary to growth, together with the grain, and the labor of harvesting is eliminated. The value of a hectare of peanuts when fed with corn and converted into 8-centavo pork is valued in the southern United States at ₱40.16. The common native peanuts now grown are very inferior to the improved Spanish varieties, which have given excellent results as forage crops in the Tropics. The seeds should be planted on ridges or in furrows—according to the season—from 60 to 90 centimeters apart, depending upon the variety, kind of soil, etc. Frequent cultivation should be practiced until the spreading of the vines renders this impossible. If the field is not overpastured the tubers left in the ground germinate, producing a continuous crop.

The chufa is a sedge having edible tuberous roots. They grow splendidly in all parts of the Islands and the crop is considered to be about equal in value to peanuts. The tuberous roots are planted in rows much the same as peanuts. Many experiments have been performed by the United States Department of Agriculture tending to show that it is more profitable to feed some grain to pigs pasturing on chufas and peanuts

than to require them to make their entire growth upon these alone.

Among the forage plants which can be grown to advantage in this country are sorghums, Japanese sugar cane, soybeans, velvet beans, and cowpeas. Orange-sweet and amber sorghums have been tested by the Bureau and found particularly adapted to this country, a seeding producing three cuttings. The value of a hectare of sorghum as pasturage, when corn is also fed, is estimated at from ₱20 to ₱40. Considering the ease with which a heavy crop of this forage can be grown and the fact that three crops are obtained from each sowing, this forage should find favor with Philippine live-stock producers.

Japanese sugar cane succeeds very well as a forage crop in the southern United States, Japan, China, and South Africa, and although it has not been grown to any great extent in the Islands without doubt it would do very well here. As a hog feed, however, it is inferior to the common bean and tuber forages. Like the sorghums the common practice is to sow in drills 75 to 90 centimeters apart, using about 13.5 kilos of seed per hectare.

Soybeans are raised extensively in the Tropics and although the various experiments with American varieties have not proven them particularly adapted to this country, no doubt some of the Indian, Japanese, or Chinese varieties would be more adaptable. The importance of this crop is such that it warrants thorough experimentation. It is very valuable both as a pasture and a grain-producing plant, and its value does not lie in its food products alone, but in the fact that it, like other legumes, has the power of adding nitrogen to the soil, thus making it of especial value in restoring land of low fertility; in addition, the roots leave the soil in a good mechanical condition. In this country where fertilization is so little employed there is a crying need of a more common use of leguminous crops. In many parts of the Tropics the soybean can be grown with greater ease than corn, being more resistant to drought or excessive moisture. The same general methods of culture may be applied as have been recommended for corn. If a crop of beans is desired it is best to plant in drills 60 to 90 centimeters apart, using from 30 to 50 kilos of seed per hectare. If a pasture is desired the seed may be sown broadcast, using about 65 kilos per hectare. In the latter case very little after-cultivation is necessary since the plants soon shade the ground and kill the weeds. The yield in forage and grain will vary widely, depending upon the conditions under which the crop is grown. From 20,000 to 28,000 kilos of green forage per hectare is only a fairly

good yield and the average soil will produce from 1,500 to 2,700 kilos of seed per hectare. The fodder ranks high in feeding value, comparing favorably with peanut tops. The beans are about two-fifths protein and one-sixth fat, or nearly 3½ times as much protein and about three times as much fat as corn. The bean meal has a very high percentage of digestibility. In using the crop as a pasture the expense of harvesting is dispensed with and the droppings from the animals are of great value in enriching the land. There are very few fruit or grain crops, however, that are so rich and can be used to such good advantage in the compounding of rations as the soybean. The only other vegetable product comparing with it is the peanut, so that in many cases it may be found more profitable to harvest the crop and use the bean meal in a mixture with other crops.

Sufficient experimenting with the velvet bean has been done to demonstrate that it can be grown successfully as a swine forage. The meal is very nutritious, comparing well with the soybean, and a wonderful amount of green forage is produced. It is perhaps best grown with a supporting crop, such as corn, sorghum, or sugar cane. The Lyon bean is cultivated in several of the provinces. It is a very heavy producer, but is subject to rust and has a very coarse stem and leaves.

Cowpeas, another leguminous forage crop, have been grown successfully at the Lamao experiment station in Bataan. The iron varieties, which are particularly disease resistant, seem to be the ones most valuable for the Philippines. The value of this plant as a grain or forage crop is inferior to the velvet bean, soybean, or peanut. The bean meals may be utilized as a component of a ration containing bulky feeds, such as tiqui tiqui, etc.

The above-mentioned feeds may be combined in various ways, some of which are suggested as follows:

No. 1.—Two-thirds Kafir corn meal; one-third bean meal.

No. 2.—Two-thirds corn meal; one-third bean meal.

No. 3.—Three parts tiqui tiqui; 2 parts corn meal; 1 part bean meal.

Peanuts may be substituted for the bean meals.

Root crops are especially valuable to the small farm inasmuch as a large quantity can be produced on a small area. They occupy a definite place in the list of swine feeds, but, owing to their high water content and bulkiness, they should not constitute the entire ration, but should be used along with components high in protein. Some of the most important root crops for this country are yautias, taros, sweet potatoes, and cassavas.

The yautia is a West Indian plant and is met with very generally throughout the Tropics. It has been grown successfully on the Bureau stations and in places near Manila. It is a heavy yielder, certain varieties often producing on moderately fertile soil 28,000 kilos of edible tubers per hectare, besides 4,500 kilos of rootstocks. The taro, or common gabi, is well known to the Filipino, being found throughout the Islands. These crops require about six months to mature. The young plants are generally set in rows about 90 centimeters apart, the distance depending upon the variety. Sections of the rootstock, as well as the tubers themselves, are used in planting.

The better varieties of native sweet potatoes, or camotes, have a feeding value about equal to the gabi, but as pasture plants they are inferior to any of the legumes mentioned.

The cassava is said to be a native of the Philippines, and although not eaten as readily by swine as some other root crops, it can perhaps be fed to advantage with a grain ration.

All these roots are often fed in a raw state, but their value is increased considerably by cooking. Any of them may be combined and fed to advantage with bean meals

As a rule very few swine are raised in the coconut districts, all the pork consumed being purchased from other localities; no doubt a greater part of this pork could be produced by utilizing the coconut milk—which at present on most plantations is entirely waste product—and in cases where oil is produced, copra meal. The "milk" is not rich enough to constitute an entire ration but must be combined with some other component. It adds considerable feeding value to tiqui tiqui, and a few planters are utilizing it in this way; the nuts are broken open on a cement sink-like platform from which drain pipes lead to some sort of receptacle. Copra meal is very rich in protein and consequently serves as a valuable adjunct to combine with bulky components in a mixed ration.

The kinds of crops to be raised and the methods of management of a farm are determined, in a large measure, by local conditions. Each district has a soil, climatic conditions, market facilities, etc., peculiar to itself—and there are many sections that are not capable of producing all the crops dealt with; every district, however, should be able to grow one or more of these crops, and even this one, if grown and used as a swine feed, will add materially to the value of the feeds now used.

AGRICULTURAL CONDITIONS AND PROSPECTS IN PALAWAN PROVINCE.

By O. B. Burrell, *Agricultural Inspector.*

The data contained in this paper was gathered during a trip covering the period from September 10 to October 13 of the present year for the purpose of inspecting and reporting upon the conditions and agricultural possibilities of Southern Palawan, with special reference to the physical features, soil formation, present vegetation, climate, labor supply, transportation facilities and suitability for agricultural purposes. From Puerto Princesa I was furnished transportation and extended every courtesy by Major James P. Harbeson who was making a visit of inspection to region on the military launch *General Lawton.*

I landed for inspection and collection of soil samples at Aborlan, Panacan, Separation Point, Brookes Point, and Bonabona on the eastern coast, and at Eran Bay and Alfonso Trece on the western coast of Palawan Island, and on the Islands of Balabac and Pandanan off the southern coast. The information concerning other points was secured from Major Harbeson, Lieutenant Speers and Lieutenant Reid. The areas given are estimates only.

LOCATION.

The Province of Palawan covers an area about 600 miles long by 125 wide, situated in the southwestern quarter of the Philippine Archipelago. Besides Palawan Island it includes the islands lying between Palawan and the Islands of Mindoro, Panay, Negros, Mindanao, the Sulu Archipelago and British North Borneo, chief of which are Busuanga, Coron, Culion, Dumaran, the Cuyo Islands, the Cagayanes Islands, Cagayan Sulu, and Balabac off the southern coast on which is the customs port of the same name.

GENERAL FEATURES.

With the exception of Cuyo and the Cagayanes, these islands contain poor farming land and are very sparsely populated. The southern half of Palawan Island, below Puerto Princesa, and the islands off the southern coast are of the greatest value for agricultural purposes; this region lies south of the typhoon belt with only a short dry season, and has been, up to the present, free from the rhinoceros beetle and other coconut insects, as well as from rinderpest and other diseases of live stock.

Extending from Puerto Princesa to the southern extremity of Palawan is a sloping plain 3 to 5 miles in width between the mountains and the Sulu Sea, mostly covered with a moderate growth of timber. The greater part of the coast line is bordered by outlying coral reefs and a strip of mangrove swamp half a mile in width; for the next half mile inland sandy loam prevails, and the balance is sand or clay loam with clay predominating. Practically no crops are grown except a little palay and vegetables in Tagbanua caiñgins, with few clumps of coconuts along the coast.

DETAILED DESCRIPTION.

The Iwahig penal reserve extends for 20 miles south of Puerto Princesa to the Saub River, about 6 miles south of Inagaun. From here to Aborlan, 8 miles, the coast is bordered by half a mile of mangrove swamp with good coconut land extending 3 to 4 miles back to the mountains. In this section are found about 1,200 hectares of open meadow land free from cogon, at present used as a cattle range. The soil is a clay loam from 20 to 60 centimeters in depth underlaid with coarse limestone gravel and would make very fair coconut land. Fencing would be necessary for the exclusion of wild hogs, and a road should be built through a mile of swamp and forest to the coast where a good anchorage could be obtained between the coast and Malanao Island half a mile out. A limited supply of laborers could be obtained from the Tagbanua reserve at Aborlan about 3 miles to the south. A telephone line runs across the center of the meadow, open from Puerto Princesa to Brookes Point, but the only available transportation would be by boat, as there are no wagon roads in the entire region with the exception of those within the Penal Reserve.

The Tagbanua reserve covers a region extending about 6 miles along the coast, with Aborlan near the center, and back to the mountain tops.

The large island lying off the coast at this point is covered with mangrove, and is worthless for agricultural purposes.

Below Aborlan to Separation Point lies a low flat plain 3 to 5 miles wide and 30 long; it is mostly dark sandy or clay loam, nearly covered with a moderate growth of timber, and of fair quality for coconuts, hemp or rubber. A few miles below Aborlan is found a large area of open cogon land; extending north

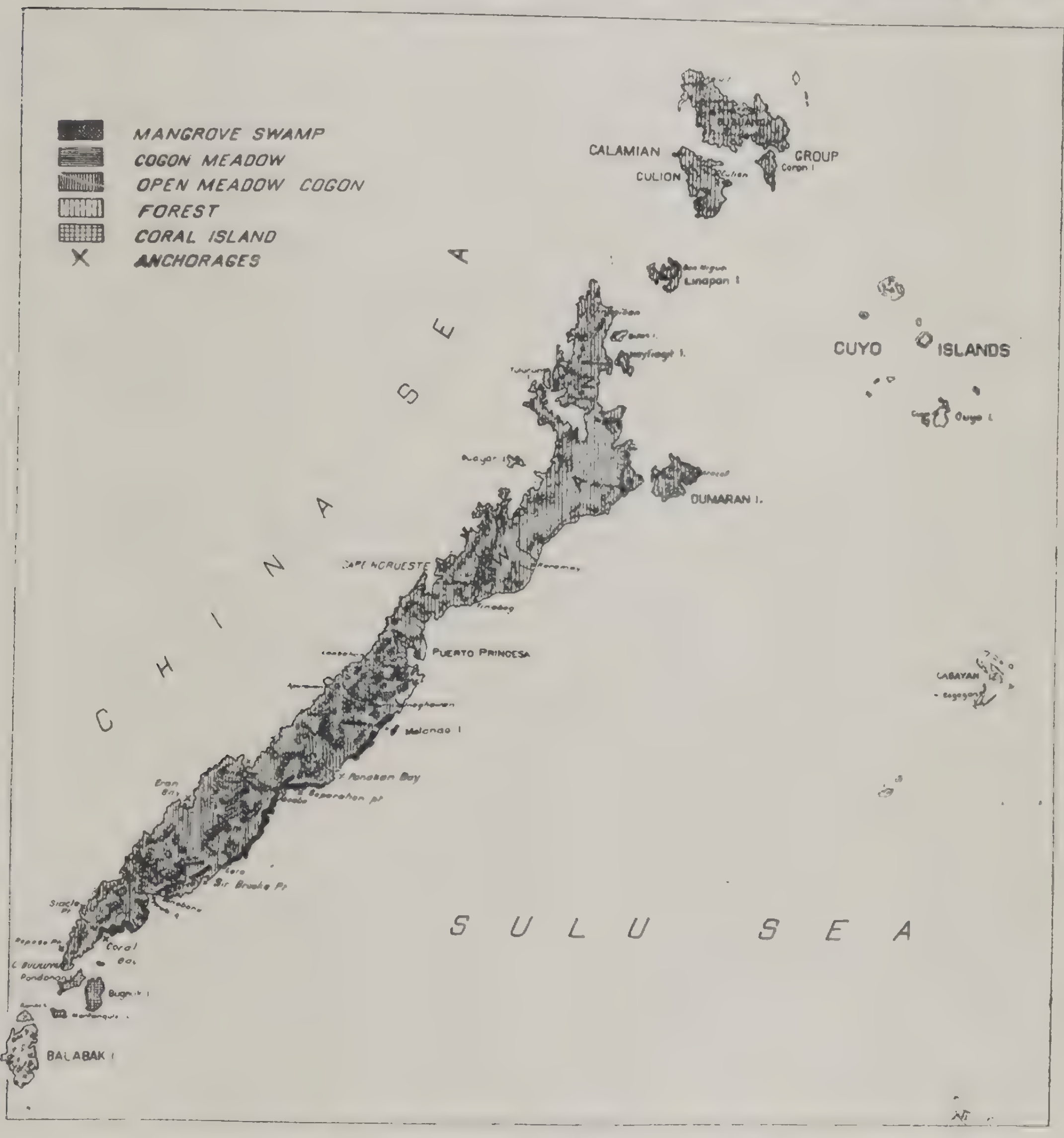

PLATE IV.—MAP OF PALAWAN PROVINCE.

from Separation Point is still another section of about 1,000 hectares of open cogon land dotted with a few small trees and clumps of small-growing bamboo, with half a mile of swamp along the coast. The soil on this meadow is a stiff clay with a little sand in spots.

From here to Brookes Point, 38 miles, the country for a few miles is much broken up by small mountains and ridges with

swampy land along the coast, but as we get farther south the strip of swamp grows narrower with occasional stretches of solid land to the beach, and a level plain extends 3 to 5 miles back to the mountains with a few open cogon patches and old caiñgins. Half a mile back from Brookes Point is a cogon meadow about 5 miles long and half a mile in width. The soil on the meadow is a stiff clay which would be difficult to cultivate in wet weather. The half-mile strip along the coast is dark sandy loam of good quality for coconuts or rubber.

Beginning four miles south of Brookes Point the Moro Reserve extends 18 miles to Pirate River. From there to the southern end of the island, 30 miles, the plain gradually grows narrower with less swampy land along the coast.

Fair anchorages are found at Aborlan, Panacan, Separation Point, Brookes Point, Bonabona, Coral Bay and at the southern extremity of Palawan Island. On the western coast the character of the soil formation and physical features are much the same as on the eastern, with anchorages at Reposo Point, Siacle Point, Eran Bay and Alfonso Trece.

Of the islands off the southern coast Balabac resembles the mainland in character with level stretches of forest and several good harbors. The low, coral islands, of which Buksac with 6,000 hectares, Pandanan with 4,000, Mantangule with 1,800, and Bancalan with 900 are the chief in size, are of the very best quality for coconuts. They are covered with a slight growth of forest with very little underbrush and no cogon or other noxious weeds. The trees could be cleared off at small expense and nuts planted among the stumps would require little care. On the mainland cogon and underbrush would spring up so thickly as to make it very expensive to care for the trees unless the land were stumped and plowed. The islands also have the advantages of being free from wild hogs and monkeys and also from mosquitos and other insects injurious to the health and comfort of the supervising and laboring force.

CLIMATE.

Moderate rains are fairly evenly distributed over nine months of the year, with more or less extended periods of drought during the months of October, February, and March or April. There are frequently one or more good rains during these months of comparative dry weather and growing crops seldom suffer from lack of moisture. The periods of dry weather are shorter as the southern end of the island is approached and generally speaking nothing is to be feared in this whole region from lack of rains.

Malaria and other fevers are fairly prevalent along the coast of Palawan Island in proximity to the extended areas of swampy land. Upon the coral islands, however, health conditions would be very good.

LABOR SUPPLY.

The native population is composed of primitive Tagbanuas who live in isolated clearings in the forest. In time a fair supply of labor could be developed from among them but at present they will work for only a few days at a time. A larger force could be secured at Cuyo but they do not like to leave their homes for more than a few months at a time, then they go home for a visit and a new lot come to take their places. At present the Culion leper colony is using about 300 of them on construction work which will be completed about September, 1912. At that time a number would be available for work in Palawan. For a permanent laboring force laborers will have to be brought in from some outside source.

TRANSPORTATION FACILITIES.

At present the *Garcia Pitogo* makes a round trip to Puerto Princesa from Manila every twenty days. The customs launch *Sura* meets the *Garcia Pitogo* upon each trip and proceeds to Balabac and Kudat, British North Borneo, stopping at intermediate points enroute. The military launch *General Lawton* makes a trip every few weeks to Brookes Point and Balabac—where Scout Stations are maintained—and furnishes transportation to those desiring it. The provincial launch *Florence* also makes occasional trips to different parts of the province. Besides these vessels there are a few schooners which transport timber across to Iloilo and take any passengers and freight available. The regular line of North German Lloyd steamers from Europe call at Kudat 90 miles south of Palawan Island, and when there is enough business to warrant it, they can be induced to visit points in Palawan.

AGRICULTURAL POSSIBILITIES.

In the region described there are in the neighborhood of 165,000 hectares of good land available for purchase or lease from the Philippine Government, to wit, about 85,000 hectares on the eastern coast, 60,000 on the western and 20,000 hectares on the islands off the southern coast of Palawan Island. Coconuts would thrive on the entire area, and rubber, hemp and other crops upon the greater part of the land. With the exception of the meadow near Aborlan, the land would have to be cleared and

stumped before planting. If coconuts were planted among the stumps and no plowing was given, the cogon grass would spring up so thickly as to prevent a satisfactory growth.

The ideal location for coconuts is upon one of the coral islands which can be easily cleared off, and no plowing is required. The new shoots from the stumps should be trimmed off for a few months until the roots die, and little further attention will be required until copra making begins.

This region has the great advantage of being free from the coconut beetle and also from live-stock diseases. There is no danger of loss from typhoons of heavy wind storms.

At present there are two large companies who are starting the developing of coconut plantations, the Delawan Bay Company on Balabac Island, and the Malanao Coconut Company on Pandanan Island, and the prospects are good for extensive development in this region of large plantations of coconuts and rubber within the next few years.

CURRENT NOTES[1]—FEBRUARY.

INCREASING INTEREST IN ARTIFICIALLY DRIED COPRA.

At last the idea of making copra has reached the American Tropics. Until very recently, with all the immense production of coconuts in tropical America, no *copra* has been made, the fresh nuts being shipped direct to Boston, New York, Baltimore, New Orleans, and a few other points. The fresh nuts are, to a large extent, made into "desiccated coconut"; that is, the fresh nut is shredded, or grated, into thin strips or shavings; these strips are then compressed by hydraulic power to express the surplus oil, and then the mass is broken up and dried, sometimes with the addition of a little sugar. The demand for coconut oil and the by-products from copra, however, is becoming so great, even in the Eastern States, that attention is now directed toward making copra from the small and broken nuts.

Probably one of the first large copra driers to be erected in the American Tropics is that which is now in operation in Georgetown, British Guiana. This machine is of the heated-air instead of steam type; it requires about twenty hours to dry one charge of the fresh "meat," thus turning out about one ton of the finished product per day. The wholesale price there is about ₱200 to ₱225 per ton, which is rather better than that for the best sun-dried Philippine copra.

At present Jamaica is exporting about 12 million raw nuts and Trinidad about 9 millions, the total value for the coconut products of Tropical America being about ₱4,000,000 per annum. Undoubtedly within the next three years, unless the coconut disease which is now spreading rapidly and doing such terrible damage in Cuba extends throughout Tropical America, the output from the use of artificial driers to save the small and broken nuts will be nearly doubled. The nuts of less than 8 or 9 centimeters in diameter are too small to use conveniently for making the desiccated products; moreover, a considerable percentage of nuts are cracked in handling previous to loading on

[1] Original notes prepared by various members of the Bureau of Agriculture.

shipboard. If some sort of copra drier can be popularized in that region a very large sum will be saved the planters. The Philippine coconut growers need not worry, however, about the price of high-grade copra—that is, unsmoked and bone-dry—going down on that account. In fact, even in the United States factories are now being established for manufacturing butter, cooking compounds, etc., from copra, more or less along the same lines which have succeeded so splendidly in France, Germany, and Holland.

DOMESTIC COCONUT PRODUCTS IN THE UNITED STATES.

At last the United States has begun to advertise *domestic* coconut products; a factory has been established at Portland, Oregon, for handling copra from the Philippines and the Pacific archipelagos. The principal product of this institution is called *Kaola,* which is a vegetable butter resembling suet, especially useful in cooking pastry and for all purposes for which ordinary animal lard can be used. This is not colored with egg yolks as some of the European articles are, but is left in its original white color. Unfortunately the uncolored condition of this butter will practically prohibit its use on the table until people learn that the yellow color of butter is quite unassociated with the question of flavor, digestibility, etc. In this connection it must be remembered that a large part of the butter of commerce is more or less colored artificially by annatto, a substance obtained from the seeds of the Achiote shrub (*Bixa orellana*), which has long been introduced into the Philippines from Tropical America.

This new Kaola butter is said to contain no water; therefore it does not become rancid and does not have any offensive odor in cooking. Its purity and wholesomeness are its strong points.

This new coconut butter costs less than half the price of dairy butter and will, we hope, rapidly find favor with the cooks and housewives of America.

BUD-ROT OF COCONUTS IN CUBA.

The following quotation from the Cuba Review will be of interest to the coconut planters of the Philippines:

> Prof. F. G. Earle, one of the commissioners appointed by President Gomez to investigate the disease which is killing coconut trees in Cuba, especially at Baracoa, Oriente Province, has made a preliminary report to the Government.
>
> He states that the exports of coconuts from Baracoa have dropped from 18 millions to 6 millions, that more than half the trees are dead, and that many more are affected. The factory for making oil from unshipped nuts that formerly operated day and night, now operates only two days a week.

The disease has been virulent five years. Affected trees are found on all kinds of soils and at all altitudes. Whole plantations have been completely destroyed, and it is a serious calamity to the district, as coconut groves are the prime source of revenue.

The bud-rot disease of Cuba appears to be identical with the Philippine bud-rot, which still exists in two or three districts here. The latest outbreak reported to this office was in the province of Misamis, Mindanao. Except for the excellent work done by Dr. E. B. Copeland a few years since in checking the spread of this terrible disease, the Philippines might to-day be in the deplorable condition of Cuba.

President Gomez of Cuba has offered a prize of ₱60,000 for the discovery of a cure for this disease.

RICE AND COCONUTS IN SIAM.

The rice crop of Siam is reported to be very short. In the southern part of the country, especially near the larger cities, the coconut industry has deteriorated very seriously in recent years, due to the attacks of coconut beetles. In fact, it is said many of the old plantations have been abandoned on account of this pest, and it is now almost impossible to establish new plantations in the vicinity of the villages which, of course, always furnish breeding places for the grubs of this insect.

A PERENNIAL RICE.

A perennial rice has just been discovered in Senegal, French West Africa. This rice, which occurs wild, or semi-spontaneous in that country, is said to spread by means of rhizomes and may be propagated by this method as well as by seed. The presence of this peculiar root system aids the plant in surviving through even an eight months' dry season. The great importance of such a variety for certain districts in the Philippines can hardly be overestimated. Furthermore, the plant is a first-class forage crop and while probably the yield is not so great as that of some of the Philippine rice varieties, the starch and food contents of the seed are fully as great as in the case of ordinary rice, while the protein is only a very little less.

PHILIPPINE AGRICULTURE AND THAT OF BRITISH WEST AFRICA.

In looking upon Philippine agriculture as it was before the influence of American example and teaching, the most striking feature of the subject, as a whole, has undoubtedly been the wastefulness, or to put it technically, the evident inattention to modern agronomic principles. As a whole, the Filipino farmer

is intelligent enough to know that in many cases he is not getting much more than one-half of the yield from his fields that he could get if he really so desired. In fact, with only some 7 millions of individuals in a country which could easily support 25 millions (and, with proper methods of tropical agriculture, 50 millions) it is, of course, quite unnecessary that the average Filipino farmer should exert himself to grow two or three crops during the calendar year when *one* crop is sufficient for all the needs of himself and family.

As an illustration of what can be done in a thickly populated country, even with severe dry season conditions to combat and difficult means of transportation, we may cite what is being done by the natives of northern Nigeria in British West Africa. In this comparatively small area some 35 millions of people are obliged to consider carefully all wastes and possibilities of losing or winning on the turn of small points in the natural conditions of the country. The British officials, who are now pacifying the country and bringing it up, so far as possible, to a level with the civilization of the Gold Coast, Lagos, and Sierra Leone, can claim but scant credit, if any, for the highly economic methods of the native population of that great grain district of the "coming continent." A correspondent from northern Nigeria writes the London Times as follows:

In the northern part of Zaria and in Kano the science of agriculture has attained remarkable development.

There is little we can teach the Kano farmer. There is much that we can learn from him. Rotation of crops and green manuring are thoroughly understood, and I have frequently noticed in the neighborhood of some villages small heaps of ashes and dry animal manure deposited at intervals along the crest of cultivated ridges, which the rains will presently wash into the waiting earth. In fact, every scrap of fertilizing substance is husbanded by this expert and industrious agricultural people.

Instead of wasting money with the deluded notion of "teaching modern methods" to the Northern Nigerian farmer, we should be better employed in endeavoring to find an answer to the puzzling question of how it is that land which for centuries has been yielding enormous crops of grain, which in the spring is one carpet of green and in November one huge cornfield "white unto harvest", can continue doing so. What is wanted is an expert agriculturist who will start out not to teach but to learn, who will study for a period, of, say, five years the highly complicated and scientific methods of native agriculture, and base suggested possible improvements for labor-saving appliances upon real knowledge.

RUBBER IN BRAZIL.

Encouragement by the Government for the planting of rubber in the State of Para, Brazil, has already resulted in the setting out of many thousands of Para trees. Awards will be given

to planters of this famous species and during the next four years it is estimated some 6 million trees will be in evidence in modern plantations.

Some eight years ago the first ball of Para rubber, collected from cultivated trees in Brazil, was shipped to one of the rubber experts of the United States Department of Agriculture at Washington, D. C. It was some 60 centimeters in diameter, and gave off such a bad odor that it was passed around from one office to another as a sort of "white elephant" for some time after its arrival. This unpleasant effluvium in fresh balls of Para rubber is due to the decomposition of the vegetable juices retained in the tissue of the rubber itself; even Castilla rubber in blocks, although carefully prepared, frequently has a pronounced odor, like that of an unventilated cow stable. In sheets this odor is, of course, not noticeable.

The new railway which Brazil is constructing around the falls of the Madeira and Mamore Rivers will open up an immense new field to the rubber collectors. This new road enters the "buffer state" of Acre, which was for some time a disputed territory between Bolivia and Brazil. It will probably be open for traffic by the middle of 1912, and it is expected that it will not only increase Brazil's output of wild rubber by some 20 to 30 per cent, but will also give the rubber district of Bolivia a new direct outlet by rail instead of over the extremely dangerous rapids of the aforesaid rivers as heretofore. This will, of course, be a strong factor in the gradual if not rapid reduction of the price to the problematical "rock bottom rate of 2 shillings per pound." As soon as rubber can be had in unlimited quantities for ₱1, or even ₱1.50 per kilo, the world will have another new delight—that of walking on rubber floors and rubber pavements.

PLANT PESTS AND DISEASES.

Cuba is rapidly losing her coconut industry, some localities having already lost about 76 per cent of their trees from bud-rot. Nearly all countries are greatly troubled by the rat pest. All the Orient is suffering from the red weevil and the black beetle, although in the Philippines there is comparatively very little damage done by either of these two insects. In Malaya, India, and the East Indies, a fungus disease, known as the "stem-bleeding fungus" (*Thielaviopsis ethaceticus*) is causing considerable damage but does not appear to be present, thus far, in the Philippines.

A root disease, supposed to be caused by a *Botryodiplodia*,

affects about one-fifth of the North Travancore district in India where about 100,000 hectares are in coconuts, and in this area the percentage of attacked palms runs from 5 to 75 per cent. A very serious root disease, as well as "bud-rot," also occurs in Trinidad, British West Indies.

A leaf-eating coconut caterpillar is very prevalent in some parts of Malaya and India.

In comparison, then, with the principal coconut-growing countries of the world, the Philippines are exceptionally fortunate in having almost no serious diseases or pests. The "bud-rot," however, should be exterminated as soon as possible, a matter of no great difficulty, providing all the planters in an affected district coöperate to that end. The black beetle will probably always be with us in the Philippines but by leaving a tree here and there to be tapped for tuba, the insects can be caught in or around the tuba tree, since they are attracted by the smell of the fermenting sap. The same method is to be recommended for exterminating the red weevil which, fortunately, appears to be very rare. By means of tuba tapping and careful and continual search for infested trees (and immediate destruction of same when found), this red weevil could be practically exterminated within two years. The only thing to be feared in this line is that the insect *may* exist in wild palms, such as the Buri, Cabo Negro, and others.

A NEW METHOD OF PROPAGATING MANGOS, ETC.

In a recent bulletin [1] of the United States Department of Agriculture, Washington, D. C., a new method of propagating mangos, mangosteens, etc., is recommended. Much difficulty has been had heretofore with the growing of these and similar fruits in the propagating greenhouses of the Bureau of Plant Industry at Washington, D. C., and this new "nurse-plant" method, which consists in inarching a very young seedling onto the stem or branch of an older plant, has several points in its favor in greenhouse work.

The bulletin states, however, that:

> These methods are inexpensive and, owing to their simplicity, may be used by persons without previous experience in the propagation of plants * * *. The most remarkable feature of the new methods lies not only in their simplicity but also in the certainty of the unions which result.

[1] The Seedling-Inarch and Nurse-Plant Methods of Propagation. By Geo. W. Oliver, Bulletin No. 202, U. S. Dept. of Agri., Bureau of Plant Industry, Washington, D. C.

It would seem that the author's idea applies only to greenhouse conditions where there is a constant high humidity that prevents the rapid and fatal drying out of the balls of earth around the seedling roots and also damage by wind movement (which would, of course, seriously interfere with the healing of the cut surfaces). Hence it unfortunately will probably be impracticable to apply this method, at least in the Tropics, to outdoor plant propagation work, excepting in small nurseries where expert labor can be had, and then only with valuable plants.

NEW EMPLOYEES FOR THE BUREAU OF AGRICULTURE.

Among the recent appointees to the Bureau of Agriculture are Messrs. H. T. Nielsen, Henry H. Boyle, and F. C. Kingman.

Mr. Nielsen comes to the Islands to assume the duties of forage expert for the Bureau of Agriculture. He is a graduate of the Kansas Agricultural College (1903), and has taken postgraduate work in farm crops and agricultural engineering at the Iowa Agricultural College. From 1904 to 1909 Mr. Nielsen held a position as scientific assistant in agronomy with the United States Department of Agriculture, being for three seasons in charge of the work on grasses and other forage crops at the Arlington experiment farm near Washington. In 1906 he was sent to Arizona and California to study the problem of leguminous cover crops for orchards. During the next two years his work was entirely in the southern states encouraging the home production of forage and the establishment of definite crop systems on the farms; later on he was employed as lecturer by the Kansas Agricultural College, afterwards accepting a position at the Kansas experiment station as assistant in coöperative experiments, being engaged in this work until his departure for the Philippines.

Mr. Boyle's first training was as an apprentice in a nursery in the District of Columbia, where he received a good education in nursery, greenhouse, and farm management. In 1901 he accepted a position in the Bureau of Plant Industry, United States Department of Agriculture, as a student assistant, from which he was promoted later to the position of expert in the propagation of tropical plants, trees and shrubs. In connection with the work on mangos and citrus propagation he was sent several times to Florida and Georgia. In 1907 he was sent by the Department to Great Britain and Ireland, in connection with the introduction of new and rare plants which at that time had been introduced into that country from north China.

The last three of Mr. Boyle's ten and one-half years' service in the Department were spent as assistant arboriculturist in the crop physiology and breeding investigations.

Mr. Kingman is a graduate of the West Des Moines High School, Des Moines, Iowa, and of the Iowa State College (1911) at Ames, Iowa. He has taken special work in soils and soil analysis and has had considerable experience in practical farm work.

BOOK REVIEWS.

By W. O. Barrett,
Chief, Division of Experiment Stations.

PRACTICAL BOTANY.

(Published by Ginn & Co.)

For several years the practical horticulturist and cropgrower has been in need of a botany which was something better than a check-list or a scientific compilation of more or less theoretical questions and discussions of nomenclature. *Pratical Botany,* by Professors Joseph Y. Bergen and Otis W. Caldwell, has over 500 pages of excellent text, beautifully illustrated, and containing a glossary of the scientific terms which might not be understood by the average agriculturist. The wealth of subject material is amazing; not only is the reader made to understand precisely *what plants are* and just how they grow and reproduce themselves, but the great groups of plants are dealt with in a very interesting style and the uses of the principal plants which make animal life pleasant or possible on the earth's surface to-day are treated in such a manner that the reader is fascinated by the procession of amazing facts and the unlooked-for explanations of common mysteries.

The authors have been very fair to the Tropics, and, in fact, to all countries where agriculturists are interested in practical botany; indeed this admirable book should be just as valuable in Cape Colony, or India, as in Europe and America. The up-to-date farmer who wishes to know what his plants are and to look at difficult problems of life, from *their* point of view, so to speak, cannot afford to be without this book. The student, too, will find information in it which would take him a long time to obtain from the standard botanies and biological reference books. Briefly, then, it is not only fresh and accurate, but exceedingly interesting and thoroughly practical.

PRINCIPALS OF RURAL ECONOMICS.

This work, by Thomas Nixon Carver (Ginn & Co., Publishers), is one of the best of the new books on agriculture, in a broad sense, as the world sees it to-day. It contains some 386 pages, but is unfortunately devoid of illustrations which, we believe, might have improved the text of the work. In this book there is scarcely a feature of modern ecology or agronomy which is not discussed in a clear, concise manner, and although the author has evidently made an attempt to avoid the deeply scientific matters, the really important ideas—even of very recent discoveries—affecting the scientific basis of agricultural principles, are well brought out.

For those who are interested in the history of the development of modern agriculture in America, the author has given a very interesting sketch of this subject in the second chapter, and the reader is carried back into the dim vistas of prehistoric civilization in such a way that before he realizes it he is getting important sidelights on the origin of crop cultivation and animal husbandry; clear paths are cut through the complex mazes of sociological problems so that he gets a correct idea, without effort, of the actual relations between the old days of the savage tribes and the precariously artificial life of the civilized communities of to-day, the economy of which is fundamentally rural and even depends more or less directly upon the vegetable and animal products of that greatest of all practical scientists—the farmer.

MONTHLY CROP CONDITIONS—NOVEMBER.

ABACA.

Albay.—The general condition of the fields is fair, though very little is being harvested at present on account of the rainy season and the present low price.

Ambos Camarines.—The output of abaca seems about the same as usual, except that there is a noticeable improvement in the grades produced.

Capiz.—The general condition of the fields is unsatisfactory; no damage has been done by storms; present price from 16 to 22 centavos per kilo.

Samar.—The present outlook for this crop is excellent, and considerable harvesting is being done.

COCONUTS.

Albay.—Copra seems to be the principal business in the town of Tobaco at present as the price remains steady at ₱16.75 per 100 kilos. This industry has increased 60 per cent over that of three months ago.

Ambos Camarines.—Considerable output of copra is still going on and there is a considerable amount of new plantings. No coconut pests have been reported in this section except a few isolated cases of beetles.

Samar.—Some damage has been suffered from an insect which destroys the leaves of the trees, but generally speaking they are in good condition.

CORN.

Batangas.—The corn crop is a failure throughout practically all the province.

Ilocos Norte.—Owing to the shortage of the rice crop the people are busy planting corn as a substitute.

Ilocos Sur.—No rain has fallen since the last baguio, September 30, and corn cannot be planted on account of the dry condition of the ground.

Isabela.—Owing to the extremely dry weather that has prevailed here during the months of October and November the farmers have been unable to plant their corn crop. However,

a considerable amount of corn still remains on deposit in the southern parts of the province.

Oriental Negros.—Corn is in very good condition and harvesting will soon begin.

Samar.—Considerable planting has been done during the month with the seeds distributed by the Provincial Governor, and according to reports these plantings are in very good condition.

RICE.

Albay.—Rice harvesting and planting are going on simultaneously in the Ligao-Libon district. While crops planted in June and July last are good with large full heads of rice, those planted later have suffered from the continued dry weather, and do not promise as well as the earlier harvest. The rats have damaged the crops in Libon and Polangui during the month, and the want of rain has caused serious loss in the crops of mountain rice along the west coast where usually sufficient rice is grown to maintain the people of that section without the necessity of buying imported grain.

Ambos Camarines.—Ambos Camarines has suffered a loss of almost, if not quite, 60 per cent of the rice crop of the Bicol River valley from the long dry weather.

Batangas.—There was a very poor rice crop this year, and in many localities it is nearly consumed, and many people in different sections are living on roots and forage.

Capiz.—The rice harvest has been gathered and a very good crop made except on the Island of Tablas where there will be less than half a crop.

Cavite.—The rice crop of this province has been ruined by the continuous drought, even those lands under irrigation having suffered for lack of sufficient water.

Ilocos Norte.—The people who suffer mostly from shortage of the rice crop are the well-to-do landowners and there is no indication that a famine will menace the poorer classes. A conservative estimate after investigation shows the damage will not be less than 40 per cent and not more than 45 per cent. This loss will be felt principally by those who export rice from this province and not by the working classes.

Ilocos Sur.—The rice crop is very poor, and will at the most be about half of last year's.

The price of rice in most of the towns is now going up. In Vigan it is ₱7.

Iloilo.—Palay (unhulled rice) which in other years at this time usually costs not more than from ₱1.50 to ₱2 per 75 kilos now

averages about ₱3 and is going up. This is a very bad indication and is due to the long dry spell which has about killed all the late plantings of rice, the estimate now being a loss of about 50 per cent. This with shortage in other provinces and countries will mean much hunger.

Isabela.—During the month of November the provincial treasurer of Isabela imported 500 sacks of rice from Manila for sale to the poor and most needy people residing in several towns throughout the province at a nominal price of ₱6.80 per sack. At the present writing the Chinese merchants have a good supply of this product on hand which they are selling at the rate or ₱7.50 to ₱8.50 per sack, according to the quality.

La Laguna.—The dry land rice in the foot hills has been harvested. It was an average crop. It matured before the dry weather could affect it, but as there is but a small amount of ground along the foot hills where rice is cultivated, the total product is small.

The low land is in need of water. The crop in San Pedro Tunasan has been completely killed by the drought. In Biñan, Santa Rosa, and Calamba, the crop will be very short due to the lack of water.

It is yet too early to estimate the crop of this year, but if there are no more rains it will fall far below the average.

La Union.—There is no doubt that the rice crop is less than one half the usual amount and the people are already becoming restless. There is a "clique" of seven prominent men in the northern part of the province who are planning to make a pool of some ten thousand pesos and import rice directly from Saigon to be re-sold at a profit to the people.

Nueva Ecija.—Owing to lack of rains the rice crop will be short 60 to 80 per cent.

Nueva Vizcaya.—During the month of November no rain has fallen. The rice fields in Badcaran and parts of Bagabag are extremely dry. Nevertheless the palay crop looks promising, and it is expected that harvesting will commence in January. The palay in the Dupax district is excellent. The mountain palay in the rancheria of Campote, Tungud and Tayupay is of very good quality.

Occidental Negros.—Good rice crops are reported in northern part of province and in La Carlota district. The town of Isabela reports rice crop doubtful, owing to dry weather.

Oriental Negros.—Dry weather has practically ruined the rice crop in Tolong and Siaton and great shortage of this staple will be felt this year in southern Negros.

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Rizal.—The recent protracted drought has caused a total failure of the rice crop in this province. In large areas there will be absolutely no harvest, and even in those favored localities where water was obtainable for irrigation purposes the crop is going to be far short of an average yield. The most expert opinion on this subject places the prospective yield of this year's crop at about ten per cent of that of former years, scarcely enough to pay for the seed.

Samar.—The price of rice, which last month reached the high water mark of ₱10.50, continues to fall. In a way, the rise in the price of rice, which put it beyond even the most well-to-do people, worked for good, as it gave stimulus to the planting of camotes and other vegetables.

Tarlac.—The rice crop in these municipalities is in a hopeless condition. Flood after flood has destroyed the biggest portion of rice planted as late as September and what was saved from the destructive action of water is now dying on account of long drought. No rain has fallen after the last flood of September and there is not even a bad system of artificial irrigation to save this crop from total loss. It will not be exagerated to put at 75 or even 80 per cent the loss of the rice crop this year for lack of water.

Tayabas.—Conditions in regard to harvesting rice are very unfavorable due to the extreme drought during the last two months. The crops in the Tiaong district have been a complete failure. In this section prices have reached from ₱10 to ₱12 per 75 liters, although in Manila it is quoted at ₱7. In the Atimonan district, however, rice seems to be plentiful and the price there is about the same as in Manila.

SUGAR CANE.

Antique.—The drought is now seriously interfering with the planting of sugar cane. From San Jose to Tibiao there has been practically no rain for seven weeks.

Bataan.—Sugar cane is in very good condition throughout the province, although at present it is too dry to begin planting the new crop.

Batangas.—The dry weather is beginning to damage the standing cane and milling has already begun.

Bulacan.—The growing crop has been damaged considerably by drought, and no land can be prepared for future planting owing to the lack of rain.

Iloilo.—Sugar milling has commenced and the price is high

due probably to the fact that purchasers do not want sugar in small lots as it is at present offered.

La Laguna.—The sugar cane is looking well in all parts of this province, and much plowing is being done in the uplands preparing the ground for early planting.

Occidental Negros.—Milling has begun on the western coast; the yield is less than that of last year but the quality is better; with the increase in price the total value of this year's crop will probably equal, if not exceed, that of last year.

Oriental Negros.—Near Bayauan sugar cane is in bad condition owing to the excessive rains of several months ago. In the vicinity of Bais the cane is doing well; more hectares are under cultivation here this year than last.

MARKET REPORTS.

NOTES ON MANILA MARKETS FOR NOVEMBER.

By KER & Co.

(Based on advices from New York, November 8; San Francisco, November 8; London, November 18; Hongkong, December 10; Iloilo, December 12; Cebu, December 9.)

SUGAR.

Market dull. Arrivals do not come up to expectations. Sugar apparently being held back by planters. We quote ₱8 per picul first cost for No. 1, nominal.

MANILA HEMP.

During the past fortnight market has been quiet but steady for better grade and although for lower grades market was easier, at the close tone all round is better. Arrivals of free Hemp of better grades are small and we quote ₱15.50 for good current say £30/10/– per ton f. o. b., for U. S. current ₱8.50 and U. K. ₱8 per picul first cost or say £18/15/– and £17/15/– per ton f. o. b. Arrivals at all ports for the fortnight were 42,979 bales.

COPRA.

Market for Cebu f. m. s. has been steady at ₱11.50 or say £21/10– per ton f. o. b.; Manila f. m. unchanged—sales made at ₱11 per picul or £20/5/– per ton f. o. b.; market closes rather quieter.

LONDON FIBER MARKET.

The following prices for Manila hemp, sisal, and maguey were quoted by Messrs. Landauer & Co., London, November 22, 1911.[1]

Manila hemp.—Receipts for the week are cabled as 26,000 bales against 23,000 bales for the corresponding week last year.

The market for fine hemp has ruled quite steady. Shippers

[1] These quotations are in pounds and shillings English currency per ton. One pound equals about 10 pesos Philippine currency. One ton equals approximately 16 piculs.

have shown little interest as sellers, but on the other hand, buyers are quite apathetic, and are not prepared to increase their stocks at present prices. Value on old contract terms £34 to £34/10–good current, £36 to £39 good marks, and £40 to £43 for primest marks.

Range of prices.

Grades.	Spot and close by.		
	Per ton.	Per ton.	Per picul.
Best marks	40/- -43/-	₱400.00–₱430.00	₱25.00–₱26.90
Good marks	38/- -40/-	380.00– 400.00	23.75– 25.00
Good current	34/- -34/6	340.00– 343.00	21.25– 21.43
25 per cent over current	22/- -22/6	220.00– 323.00	13.75– 13.95
Fair current	20/- -20/3	200.00– 201.50	12.50– 12.59
Superior seconds	19/6 -19/9	193.00– 194.50	12.10– 12.16
Good seconds	19/3 -19/6	191.50– 193.00	11.97– 12.10
Fair seconds	19/- -19/3	190.00– 191.50	11.85– 11.97
Good brown	18/- -19/-	184.50– 190.00	11.55– 11.85
Fair brown	18/- -19/-	184.50– 190.00	11.55– 11.85

Sisal hemp.—Dull. The price in New York is 4⅝ cents, equal to £22–10/– to £22–15/– c. i. f. Europe. Trifling quantities in store quoted at £23.

Manila maguey fiber.—Steady. We quote No. 1 Cebu at £19, ordinary No. 1 at £16, No. 2 at £15 and No. 3 at £13–15/.

MANILA AND LONDON FIBER MARKET.

Receipts and shipments of Manila hemp.

[Telegram from Manila to London, December 26, 1911.]

		1911	1910
Hemp receipts at:		*Bales.*	*Bales.*
Manila since January 1		981,826	1,016,845
Cebu, etc., since January 1		255,466	301,139
All ports since January 1		1,237,292	1,317,984
Shipments by steamers to:			
United Kingdom, cleared since January 1		468,480	529,637
Atlantic coast, United States, cleared since January 1		359,762	467,369
Pacific coast, United States, cleared since January 1		164,311	105,555
Continental ports, cleared since January 1		98,594	88,252
Shipments to:			
All other ports	71,147		
Local consumption since January 1	26,920		
		98,067	71,359
Loading steamer on the berth for:			
United Kingdom, about		30,000	37,000
Atlantic coast, United States, about			28,000
Pacific coast, United States, about		5,000	
Shipments per sailer to Atlantic coast, United States, since January 1			20,650

Bales of hemp loading for United Kingdom, by steamer: Birkenfels	30,000
Bales of hemp loading for Pacific coast, by steamer: Suveric	5,000

ILOILO SUGAR MARKET.

The arrivals of sugar in Iloilo from the mills and sugar districts in the month of November were 25,805 piculs.

During the month of November the price of sugar remained constant at 8 pesos 2 reales [1] from the 1st to the 13th, when it dropped to 7 pesos 7 reales; on the 14th there was a still further decline to 7 pesos 4 reales, at which figure it remained constant until the end of the month.

[1] One real equals 12½ centavos.

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM QUARTERLY CROP REPORTS FOR THE QUARTER ENDING JUNE 30, 1911.

By BENJ. P. LUKENS, *Acting Statistician.*

(NOTE.—Attention is invited to the fact that rice should be understood as being in the unhulled state. 75 liters = 1 cavan; 63.25 kilos = 1 picul; 46 kilos = 1 quintal; 11.5 kilos = 1 arroba; 0.4047 hectare = 1 acre.)

Province and crop.	Condition.	Planted during quarter.	Harvested during quarter.	
			Area.	Quantity.
		Hectares.	*Hectares.*	
Agusan:				
Rice	Good	594	1,735	853,950 liters.
Sugar	Fair	2	3	759 kilos.
Corn	Fair	70	105	94,200 liters.
Abacá	Good	5	1,839	455,780 kilos.
Copra	Good			41,492 kilos.
Albay:				
Rice	Fair	3,168	2,657	3,412,275 liters.
Sugar	Fair	39	58	87,285 kilos.
Corn	Fair	1,005	184	113,775 liters.
Abacá	Good	1,493	26,934	6,742,197 kilos.
Copra	Fair			2,695,715 kilos.
Cacao	Fair	2	26	3,868 kilos.
Ambos Camarines:				
Rice	Fair	1,753	12,392	19,227,300 liters.
Sugar	Fair	110	262	109,422 kilos.
Corn	Fair	237	164	72,000 liters.
Abacá	Good	243	22,802	6,096,098 kilos.
Copra	Good			692,398 kilos.
Cacao	Poor		51	6,498 kilos.
Antique:				
Sugar	Good	656	958	1,061,588 kilos.
Tobacco	Fair		78	18,068 kilos.
Corn	Good	692	727	665,250 liters.
Abacá	Good	78	42	23,023 kilos.
Copra	Fair			21,758 kilos.
Bataan:				
Rice	Fair	247	359	1,125,750 liters.
Corn	Fair	211	22	38,620 liters.
Batanes:				
Rice	Fair	10	8	2,400 liters.
Tobacco	Good		13	1,380 kilos.
Corn	Fair	29	20	19,275 liters.
Batangas:				
Rice	Fair	19,416	228	438,670 liters.
Sugar	Fair	2,836	1,163	1,793,707 kilos.
Tobacco	Good		26	13,294 kilos.
Corn	Fair	7,123	244	194,400 liters.
Abacá	Good	13	60	15,433 kilos.
Copra	Fair			21,758 kilos.
Cacao	Fair	7	7	2,185 kilos.
Bohol:				
Rice	Fair	3,942	17,061	9,016,875 liters.
Sugar	Fair	596	98	35,420 kilos.
Tobacco	Fair		135	46,460 kilos.
Corn	Fair	4,894	1,214	1,305,450 liters.
Abacá	Fair	6	498	220,047 kilos.
Copra	Good			1,750,570 kilos.
Maguey	Good	10	95	27,261 kilos.

Crops planted and harvested, etc.—Continued.

Province and crop.	Condition.	Planted during quarter.	Harvested during quarter. Area.	Quantity.
		Hectares.	*Hectares.*	
Bulacan:				
Rice	Fair	1,372	5,954	8,419,200 liters.
Sugar	Fair	1,082	87	35,104 kilos.
Tobacco	Fair		13	1,978 kilos.
Corn	Fair	1,903	192	133,650 liters.
Cagayan:				
Rice	Fair	3,937	1,441	1,646,400 liters.
Tobacco	Fair		7,361	3,178,646 kilos.
Corn	Fair	51,464	3,314	3,318,525 liters.
Capiz:				
Sugar	Good	144	88	38,962 kilos.
Tobacco	Fair	12	280	45,218 kilos.
Corn	Fair	1,270	1,134	1,430,400 liters.
Abacá	Fair	145	705	271,216 kilos.
Copra	Fair			386,774 kilos.
Cavite:				
Rice	Fair	4,262	796	912,750 liters.
Sugar	Fair	270	196	146,107 kilos.
Tobacco	Fair		29	6,670 kilos.
Corn	Fair	978	120	15,000 liters.
Abacá	Fair	218	215	50,916 kilos.
Copra	Fair			7,147 kilos.
Cebu:				
Rice	Fair	1,252	1,558	693,525 liters.
Sugar	Good	933	601	821,681 kilos.
Tobacco	Fair		6,875	4,220,086 kilos.
Corn	Fair	66,964	7,794	9,327,675 liters.
Abacá	Fair	95	1,735	642,936 kilos.
Copra	Good			1,221,610 kilos.
Maguey	Good	384	1,095	491,832 kilos.
Cacao	Poor	9	76	8,418 kilos.
Ilocos Norte:				
Sugar	Fair	637	502	884,045 kilos.
Tobacco	Fair	80	1,882	1,048,092 kilos.
Corn	Fair	671	718	474,675 liters.
Ilocos Sur:				
Rice	Fair	1,039	299	202,500 liters.
Sugar	Good	904	710	2,054,423 kilos.
Tobacco	Fair		701	338,836 kilos.
Corn	Fair	1,783	1,713	1,115,100 liters.
Maguey	Good	66	1,526	1,360,191 kilos.
Iloilo:				
Rice	Good	22,540	770	576,150 liters.
Sugar	Good	4,754	1,584	1,824,573 kilos.
Tobacco	Fair		927	223,974 kilos.
Corn	Fair	3,359	1,673	640,200 liters.
Abacá	Good	261	374	104,805 kilos.
Copra	Good			93,104 kilos.
Isabela:				
Rice	Fair	170	365	273,750 liters.
Tobacco	Fair		14,250	5,159,222 kilos.
Corn	Fair	20,122	8,434	4,734,375 liters.
La Laguna:				
Rice	Fair	1,646	12,818	3,229,850 liters.
Sugar	Good	1,097	728	737,375 kilos.
Corn	Good	242	97	90,900 liters.
Abacá	Fair	92	453	115,305 kilos.
Copra	Fair			2,553,835 kilos.
Cacao	Fair		45	2,852 kilos.
La Union:				
Sugar	Fair	67	177	288,736 kilos.
Tobacco	Fair		3,698	2,478,756 kilos.
Corn	Fair	849	24	10,875 liters.
Cacao	Fair		3	966 kilos.
Leyte:				
Rice	Fair	6,570	8,838	11,066,475 liters.
Sugar	Fair	238	420	692,254 kilos.
Tobacco	Fair	365	2,006	476,606 kilos.
Corn	Good	6,589	3,718	3,450,150 liters.
Abacá	Fair	756	12,188	3,947,875 kilos.
Copra	Fair			468,800 kilos.
Mindoro:				
Rice	Fair	510	12	27,000 liters.
Tobacco	Good		50	22,816 kilos.
Corn	Good	59	92	138,300 liters.
Abacá	Good	33	316	88,678 kilos.
Copra	Fair			15,496 kilos.

Crops planted and harvested, etc.—Continued.

Province and crop.	Condition.	Planted during quarter.	Hravested during quarter.	
			Area.	Quantity.
		Hectares.	*Hectares.*	
Misamis:				
Rice	Good	4,410	745	435,370 liters.
Sugar	Good	15	5	10,436 kilos.
Tobacco	Fair		5	2,852 kilos.
Corn	Fair	2,980	142	49,500 liters.
Abacá	Fair	101	6,954	1,186,380 kilos.
Copra	Good			1,854,047 kilos.
Moro:				
Rice	Good	795	973	707,625 liters.
Sugar	Good	358	78	69,232 kilos.
Tobacco	Good	3	10	1,012 kilos.
Corn	Fair	213	123	94,500 liters.
Abacá	Good	360	8,103	2,028,744 kilos.
Copra	Good			585,632 kilos.
Mountain:				
Rice	Fair	541	2,637	3,350,550 liters.
Sugar	Fair	68	17	6,388 kilos.
Tobacco	Fair	506	619	160,172 kilos.
Corn	Fair	1,474	461	330,075 liters.
Nueva Ecija:				
Sugar	Fair		5	3,099 kilos.
Tobacco	Fair		484	150,926 kilos.
Corn	Good	960	34	36,100 liters.
Nueva Vizcaya:				
Rice	Poor	5	227	170,250 liters.
Sugar	Fair	68	80	54,585 kilos.
Tobacco	Fair		78	38,686 kilos.
Corn	Fair	76	113	44,100 liters.
Occidental Negros:				
Rice	Good		200	150,000 liters.
Sugar	Fair	9,959	13,029	25,179,066 kilos.
Tobacco	Fair		1,033	607,430 kilos.
Corn	Good	5,379	590	273,750 liters.
Abacá	Fair	43	810	116,317 kilos.
Copra	Good			248,319 kilos.
Oriental Negros:				
Rice	Fair	69	86	129,450 liters.
Sugar	Fair	396	1,333	1,918,056 kilos.
Tobacco	Fair		347	201,434 kilos.
Corn	Fair	10,716	1,139	554,550 liters.
Abacá	Fair	174	790	514,539 kilos.
Copra	Fair			636,548 kilos.
Palawan:				
Tobacco	Fair		10	1,656 kilos.
Copra	Good			77,418 kilos.
Pampanga:				
Rice	Fair	3,662	6,714	11,644,275 liters.
Sugar	Fair	6,116	1,498	2,319,504 kilos.
Tobacco	Good		52	24,840 kilos.
Corn	Fair	8,053	228	149,250 liters.
Pangasinan:				
Sugar	Fair	375	48	15,053 kilos.
Tobacco	Fair		5,439	2,391,034 kilos.
Corn	Fair	10,348	1,189	2,875,425 liters.
Copra	Good			795,116 kilos.
Maguey	Fair	28	99	31,335 kilos.
Cacao	Fair	17	67	59,110 kilos.
Coffee	Poor	12	64	1,483 kilos.
Rizal:				
Rice	Fair	1,103	1,620	3,562,750 liters.
Sugar	Fair	1,509	263	234,404 kilos.
Tobacco	Fair		7	3,634 kilos.
Corn	Fair	1,329	270	186,075 liters.
Samar:				
Rice	Fair	3,463	9,364	13,048,875 liters.
Sugar	Good	598	138	36,685 kilos.
Tobacco	Fair	49	376	98,772 kilos.
Corn	Good	1,700	279	390,375 liters.
Abacá	Good	8,559	6,372	2,444,360 kilos.
Copra	Fair			460,587 kilos.
Sorsogon:				
Rice	Fair	1,179	9,338	8,529,525 liters.
Sugar	Good	88	136	84,692 kilos.
Tobacco	Good		165	36,708 kilos.
Corn	Fair	847	414	217,725 liters.
Abacá	Good	227	14,512	3,053,078 kilos.
Copra	Good			87,412 kilos.

Crops planted and harvested etc.—Continued.

Province and crop.	Condition.	Planted during quarter.	Harvested during quarter.	
			Area.	Quantity.
		Hectares.	*Hectares.*	
Surigao:				
Rice	Fair		12,859	8,925,450 liters.
Sugar	Fair	88	137	58,127 kilos.
Tobacco	Good	71	23	7,774 kilos.
Corn	Good	1,645	316	231,075 liters.
Abacá	Good	147	1,840	504,609 kilos.
Copra	Good			143,894 kilos.
Tarlac:				
Rice	Fair	4,200	14,288	19,695,000 liters.
Sugar	Good	2,055	61	39,658 kilos.
Tobacco	Good	25	73	33,994 kilos.
Corn	Fair	989	769	282,000 liters.
Tayabas:				
Rice	Fair	7,222	13,303	3,534,425 liters.
Sugar	Good	141	296	280,387 kilos.
Tobacco	Fair		200	95,220 kilos.
Corn	Fair	332	420	201,050 liters.
Abacá	Good	102	420	179,377 kilos.
Copra	Good			3,041,882 kilos.
Zambales:				
Sugar	Good	61	32	33,323 kilos.
Tobacco	Fair		46	24,702 kilos.
Corn	Fair	93	36	14,025 liters.
Maguey	Fair	8	15	10,436 kilos.

RANGE OF PRICES OF PHILIPPINE AGRICULTURE PRODUCTS.

By BENJ. P. LUKENS, *Acting Statistician.*

Highest and lowest prices of unhulled rice, corn, sugar, tobacco, abacá, and copra for quarter ending June 30, 1911.

[NOTE.—75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal.]

Provinces.	Unhulled rice (per 75 liters).		Corn (per 75 liters).		Sugar (per 63.25 kilos).		Tobacco (per 46 kilos).		Abacá (per 63.25 kilos).		Copra (per 63.25 kilos).	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan	₱5.00	₱3.00	₱2.50	₱1.50					₱10.00	₱6.32	₱9.48	₱6.32
Albay	4.50	2.25	3.75	2.25					12.00	5.69	11.38	5.06
Ambos Camarines	3.75	1.50	4.00	1.50					7.59	5.00	10.25	5.06
Antique	4.00	3.00	2.25	1.50	₱9.48	₱4.50	₱20.70	₱11.50	17.70	7.59	9.48	7.59
Bataan	3.00	1.87	3.75	1.50	9.00	6.32						
Batanes	4.50	1.50	4.50	2.25			9.20	8.28				
Batangas	3.50	2.25	4.00	2.25	9.48	3.80	11.50	9.20	17.00	16.00	13.91	6.32
Bohol	4.50	2.50	4.50	1.50	9.48	3.80	23.00	5.52	12.00	6.32	10.75	7.00
Bulacan	3.00	2.25	4.50	2.00	7.59	4.45						
Cagayan	5.25	3.25	3.00	1.50			25.30	6.90				
Capiz	4.50	2.25	3.75	1.50	8.85	4.43	23.00	4.60	18.00	5.98	9.00	5.69
Cavite	3.37	2.25	3.75	1.50					19.00	16.44		
Cebu	4.50	3.00	5.25	3.75	8.22	4.43	23.00	5.52	13.28	6.95	11.38	5.06
Ilocos Norte	4.50	2.50	4.00	1.50			10.00	4.60				
Ilocos Sur	4.50	2.25	4.00	1.50	5.50	4.00	23.00	5.00				
Iloilo	3.75	2.50	3.75	2.00	9.48	5.00	20.00	5.98	15.81	11.96	11.00	6.32
Isabela	5.20	3.00	5.00	3.00			28.00	9.66				
La Laguna	3.75	2.00	3.00	1.50	10.00	6.32			7.59	5.06	9.48	6.32
La Union	3.75	1.87	4.00	2.25	9.48	4.43	10.00	4.60			8.22	6.00
Leyte	4.50	2.00	4.50	2.25	6.32	4.43	27.60	13.80	11.38	4.50	10.12	5.69
Mindoro	3.75	3.00	3.75	2.00					13.91	7.59		
Misamis	4.50	2.25	4.50	1.50					11.38	5.06	10.12	8.85
Moro	3.75	1.50	3.75	2.25					13.28	6.95	12.65	5.06
Mountain	5.00	2.25	2.25	1.50			23.46	4.60				
Nueva Ecija	3.75	2.00	4.50	1.50	10.00	5.06	17.00	5.52				
Nueva Vizcaya	4.50	1.50	3.75	1.50			23.00	11.00				
Occidental Negros	4.12	2.25	3.75	2.00	8.22	5.06			17.00	7.59	12.00	5.06
Oriental Negros	4.50	2.25	5.25	2.50	6.95	5.06	25.00	5.06	13.91	5.06	10.75	7.59
Palawan	3.00	2.25									7.59	5.06
Pampanga	3.37	2.25	2.57	1.50	6.95	3.80	13.80	10.00				
Pangasinan	4.50	1.75	4.50	1.50	10.12	3.80	23.00	4.60			12.65	5.69
Rizal	3.00	2.25	5.00	1.75	8.00	4.43						
Samar	3.75	1.50	3.75	2.50	7.59	6.32	25.00	6.90	12.65	7.59	8.22	5.06
Sorsogon	4.50	1.87	3.00	2.25			23.00	9.20	17.08	7.59	9.48	6.32
Surigao	3.75	2.25	3.75	2.25					11.38	5.69	8.85	7.59
Tarlac	2.50	1.50	2.25	1.50	8.22	3.80						
Tayabas	4.50	1.50	4.50	1.50			18.40	5.98	16.00	5.69	8.50	4.25
Zambales	2.50	2.25	3.00	2.25			12.00	11.00				

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—NOVEMBER.

By the COLLECTOR OF CUSTOMS.

IMPORTS.

		Manila.	Cebu.	Iloilo.	Total.
Rice	Kilos	3,805,243	193,492	862,464	4,861,199
	Value	$211,297	$8,171	$33,617	$253,085
Beef cattle	Number	2,101		190	2,291
	Value	$45,868		$4,815	$50,683
Eggs	Dozens	348,904		288	349,192
	Value	$27,509		$39	$27,548
Sugar	Kilos	127,274	11,560	34,607	173,441
	Value	$10,845	$1,154	$3,001	$15,000
Coffee	Kilos	38,639		317	38,956
	Value	$14,650		$190	$14,840
Cacao	Kilos	44,049		3	44,052
	Value	$14,981		3	$14,984
Raw cotton	Kilos	35,509			35,509
	Value	$10,838			$10,838

EXPORTS.

		Manila.	Cebu.	Iloilo.	Total.
Hemp	Kilos	11,601,226	3,728,587		15,329,813
	Value	$1,118,592	$376,854		$1,495,446
Copra	Kilos	20,484,599	7,469,929	959,901	28,914,429
	Value	$2,189,167	$790,778	$94,728	$3,074,673
Sugar	Kilos	3,556,048		5,735,918	9,291,966
	Value	$237,978		$321,315	$559,293
Cigars	Number	14,626,796			14,626,796
	Value	$213,449			$213,449
Cigarettes	Number	1,903,050			1,903,050
	Value	$2,273			$2,273
Tobacco	Kilos	1,303,676			1,303,676
	Value	$218,050			$218,050

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

NOVEMBER, 1911.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	28.1	------	26.3	10.5	25.7	5.1	28.3	3.6	26.2	1.0	27.2	------
2	26.1	2.9	26.9	------	26.9	------	27.8	------	25.5	------	27.8	------
3	26.5	3.6	26.5	3	26	3.3	27.2	------	25.8	4.8	26.8	------
4	26.2	------	26.3	------	26.1	------	27.2	------	25.2	.5	26.4	------
5	26.4	------	26.4	------	25.6	------	26.2	------	25.5	.3	25.6	------
6	25.2	5.3	26.1		25.5		25.7		25.5		24.8	
7	24.2	7.1	26.4	.8	26.3	10.2	26.5	------	23.9	1.4	26.2	------
8	25.4		26.4		26.1		26.4		24.4		25.2	
9	26.3	------	26.3	------	26.5	------	26.9	------	24	------	26	------
10	26.8	------	26.4	3.8	26.2		26.6		22.2		?	
11	26.3	------	25.9	------	25	------	25.8	------	22.4	------	24.8	------
12	25.2	7.4	26		25.2		26		23.2		24.2	
13	26.5	5.6	25.8	17.2	26.5	25.1	25.4	------	23.9	3.3	24.2	------
14	27.3	------	26	11.3	25.7	3	26.2	------	24.2	------	25	
15	26.5	19.5	26.1	8.6	26.4	------	26.4	------	24	------	25.3	------
16	26.3	12	26.6	8.3	27.2	.3	27.6	------	25.2	------	25.6	------
17	27.7	3.3	25.2	20.5	26.8	1.8	26.2	------	24.8	.8	26.6	------
18	26.5	8.4	25.4	8.1	26.3	2.9	27		24.6		26.4	
19	27.2	14	25.8	4.6	26.8	------	27.1	------	24.5	------	26	------
20	27.2	22	26	3.8	27	2	26.8	------	23.9	1.3	26.2	------
21	27.1	30.7	26.2	4.5	27.3	------	27.5	------	25.1	------	26.6	------
22	27.7		26.8	10.7	27		26.8		25.2		26.3	
23	27.9	1.8	27	------	27.1	.8	26.6	------	25.6	2.8	25.9	------
24	27.2	4.1	26.6	7.6	27.5	------	27.6	------	25.2	20.4	26.5	------
25	27	3	26.3	11.7	26.9	------	26.7	------	25.1	------	26	------
26	26.9	------	26.2	3.1	26.3	2.3	26.3	------	24.7	------	26	------
27	26.4	1	26.8	1.8	25.6	2.8	26	------	24.2	------	25.7	------
28	26.6	------	26.6	5.6	26.5	------	26.6	------	25.2	------	25.8	------
29	27.6	4.3	26.7	6.4	26.4	.5	25.6	------	25	------	27.3	------
30	25	28.4	25.8	4.8	24.7	11.9	26	------	25.4	------	26	

Plate I.—ROSELLE IN THE FIELD (SINGALONG EXPERIMENT STATION, MANILA.)

THE PHILIPPINE
Agricultural Review

VOL. V MARCH, 1912 No. 3

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURE.

EDITORIAL.

THE FIRST PHILIPPINE EXPOSITION.

At the time the present number of the REVIEW goes to press the opening of the first Philippine Exposition is close at hand. The April REVIEW will be published as a special exposition number and will contain a series of articles concerning the agricultural and other industrial features of the exposition.

From the character and quantity of the exhibits that are now being installed in the various buildings, there is every indication that this First Philippine Exposition will be in every way a splendid success. The various exhibitors are trying not only to attract the attention of the Philippine planter and the Philippine

merchant, but are also endeavoring to get and hold the attention of every one who, either as a tourist, resident, or prospective investor, may be interested in the amazingly numerous and varied products of the Archipelago.

The most prominent feature of this exposition, it is believed, will be the exhibits of the provincial governments, of which there are now about thirty.

The Bureau of Agriculture has a very commodious and well-fitted building, 40 by 25 meters, located opposite the Machinery Hall, near the east end of the grounds; and it is expected the exhibits of fruits, vegetables, fibers, sugar, tobacco, coconuts, rices and other grains, etc., will attract as much attention as any other one feature on the grounds. Special booths will be fitted up to show how the more than one million packages of vegetable seeds are distributed; how citrus, and other plants are budded and how cuttings are propagated; how the termite, or white ant pest, may be controlled; and, if nothing seriously interferes, a new-system steam copra drier, recently devised by the Bureau, will be shown the public for the first time.

Another very attractive feature of the agricultural exhibits will be the live stock; the commodious sheds for the animals are also at the east end of the grounds and are somewhat larger than those of the exhibits at the Carnivals the previous years.

Numerous charts have been made which will enable the busy sightseers to take in at a glance the principal statistics connected with the agricultural resources and industries of the islands. Bulletins and circulars, published by the Bureau of Agriculture, dealing with various crops, fruits, pests, etc., will be distributed to interested individuals. It is intended also to present collections of vegetable and flower seeds to deserving students and to planters.

ROSELLE, ITS CULTIVATION AND USES.

By P. J. WESTER, *Horticulturist.*

INTRODUCTORY REMARKS.

The roselle is one of the most recent and promising introductions of the Bureau of Agriculture that has found a congenial home in the Philippines. The writer, having devoted considerable time to the study of this plant in Florida, obtained seed of the Rico variety described below from the Hawaii Agricultural Station, Honolulu, Hawaii, on his way to the Philippines in 1911, and procured seed of the Victor from the office of seed and plant introduction, Bureau of Plant Industry, United States Department of Agriculture. More recently seed of another variety was obtained from the Buitenzorg botanic garden, Java, by Mr. M. M. Saleeby, fiber expert of this Bureau. Seeds of one red- and one white-fruited variety of roselle, both very distinct from any varieties hitherto seen by the writer, were received by the Bureau in November from the Gold Coast, Africa. Seeds of a white-fruited variety were also obtained from Hawaii together with the Rico, but they failed to germinate. Victor and Rico have been grown during the past year at the Bureau's experiment stations in Singalong, Lamao, Alabang, and La Carlota, and, as was expected, it was demonstrated that the Philippines are well adapted to the culture of the roselle. A large quantity of roselle seed was harvested in December which is now being distributed throughout the Archipelago, and arrangements are being made for an even wider distribution next year. Those referred to above are, however, not the first introductions of the roselle into the Philippines: the plant was introduced from Trinidad, British West Indies, in 1905, by Mr. W. S. Lyon, then horticulturist of the Bureau of Agriculture, and the writer sent seed of the Victor to the Bureau from Miami, Florida, in 1908. However, neither of these introductions were permanent and the roselle never obtained a hold among the rural population of the Archipelago. It is rather remarkable that, known in Java about the middle of the seventeenth

century, the roselle was not introduced into the Philippines until two hundred and fifty years later, and then from the Western Hemisphere.

Once well introduced and the people accustomed to its uses, the roselle should become a favorite with Caucasians and Filipinos alike on account of the pleasantly acid flavor of the preparations made from the parts of the plant used for culinary purposes, a flavor which strongly reminds one of the cranberry. Considering also that the requirements of the plants are so few and its cultivation so simple, the roselle should become an indispensable plant in the garden of every family. Aside from its uses as a household plant there appears to be no good reason why the roselle should not sometime supply its quota of raw material to the canning and preserving factories that sooner or later are destined to become established in the Philippines. Thus the plant may become of considerable industrial importance. Aside from its economic value the roselle may well be grown as an ornamental.

The roselle is probably the only plant in the world whose calyces are utilized as food, which, however, possess rather a low nutritive value. Considering how closely it resembles the cranberry in flavor it is rather singular that its season of maturity also coincides with the season of maturity of that fruit.

HISTORY, BOTANY AND GEOGRAPHICAL DISTRIBUTION.

The roselle has long been in cultivation in Mexico, parts of Central America, and the West Indies, and great interest in it as a household plant has been manifested during the last few years in south Florida, Texas, and California. It has been reported to be a horticultural crop of considerable prominence in Queensland, Australia, 2 preserving factories being in operation for using the calyces as early as twenty years ago,[1] and roselle jam is said to have been exported to Europe in large quantities in 1896.[2] Granting that the authorities quoted were correctly informed, it would seem that the roselle-preserving industry in Queensland has suffered a decline, since the census in the annual report, Queensland department of agriculture, 1909, page 211, gives as under cultivation there only 1.6 hectares producing 284 hectoliters of calyces worth ₱810.

The roselle is a native of the Old World, probably India and adjacent islands. Recorded from Europe in 1576, it is not known how the roselle was introduced there, but it was probably

[1] Semler, H., Die Tropische Agricultur, 1892, p. 391.
[2] Rep. Cal. Agr. Expt. Station, 1896–1897, p. 382.

brought westward from India by the Mohammedans, who invaded and occupied India in the eighth century A. D. The fact that the name *sabdariffa* by which it was first known and now its specific name is of Turkish origin, lends color to this belief. The plant had found its way to a botanical garden in England as early as 1596, and was probably brought from there to Jamaica. It was, however, not recorded from that island until more than one hundred years later. From Jamaica the species was introduced into Florida, probably in the seventies or eighties of the nineteenth century, and was first grown in California from seed imported from Australia about fifteen years ago. The roselle is now found in most tropical countries.

It would seem that the culinary use of the calyces was first appreciated in Jamaica early in the eighteenth century,[1] for although the acid properties of the plant were known by those who described the plant after its first appearance in Europe, there is no evidence that they were aware of the utility of the calyces, and yet the use of its leaves for pottage or "greens" was known in Java as early as 1658. Notwithstanding the early mention of the uses of the roselle from Jamaica the plant has never become of much importance in the West Indies. In India it has been grown chiefly for its fiber.

The roselle (*Hibiscus sabdariffa* L.) is *Malvaceous*, and thus related to the okra, hollyhocks, and cotton. The roselle somewhat resembles the cotton plant in habit and branches profusely. The leaves are, on the young plant, entire, and as the plant grows larger, change to palmately five-parted, sometimes rather obscurely so; the leaves, in the axils of which the flowers are borne, are three-parted or entire. The flowers are large, pale yellow with a dark red eye, almost sessile, and usually borne singly in the leaf axils. In rich soils the plants sometimes exceed 2 meters in height with a like spread if the seed is sown early in the year and the plants are well cared for. Two very distinct types of roselle exist: one containing a red pigment that gives the brilliant red color so characteristic of all products made from the plants of this type, and one type lacking this pigment, all parts of the plant being greenish and the calyces straw colored or whitish. The jelly and allied products made from this latter type of roselle are straw or amber colored.

[1] Sloane, H., Natural History of Jamaica 1:224, 1707, says: "It is planted in most gardens in this Island. The capsular leaves are made use of for making Tarts, Gellies, and Wine, to be used in fever and hot distempers, to allay heat and quench thirst."

VARIETIES.

While the culinary uses of the plant have been known for a considerable length of time, the roselle is of so comparatively recent cultivation that there has scarcely been time for the splitting up of the species into many different varieties. How recently the economic value of this species has become recognized is apparent from the fact that it was not included by De Candolle in his "Origin of Cultivated Plants," published in 1882. A variety having light green stems and leaves with straw-colored or whitish calyces was recorded by Hughes [1] about one hundred and sixty years ago; how long it had existed before that time and where it originated is not known.

Among the red-stemmed type—the original—there seem to have been no distinct varieties recognized until the Victor was named by the writer in 1907. This variety originated among a number of seedlings grown by the writer in 1904 at the subtropical laboratory, Miami, Florida. The strain from which this variety originated had been introduced into Florida from Jamaica.

Victor.—This variety is distinguished by having the unifoliolate leaves of the young plant change early into leaves deeply five lobed, these leaf characters remaining until the flowering period when the leaves become three parted or again unifoliolate. The stems and calyces are reddish. The pollen is a golden brown. The calyces average about 45 to 50 millimeters in length and 28 millimeters in equatorial diameter, tapering toward apex; the calyx lobes are frequently convolute, and the fleshy spines subtending the calyx lobes are longer and more slender than in the Rico, and are curved upward. The Victor is more upright in habit than the Rico and somewhat earlier in fruiting, due probably to its having been cultivated in Florida for several years. (*See* Plate III.)

Rico.—The young plants of the Rico retain their unifoliolate leaf characters longer than the Victor, and later are mostly tripartite instead of five parted. The stems and calyces are dark red and the leaves dark green with reddish veins. The pollen is golden yellow. The calyx is of about the same length as the Victor but of greater equatorial diameter; the fleshy spines subtending the calyxlobes are stout, and stand at nearly a straight angle from the axis of the fruit; the apex of the calyxlobes are frequently incurved. (*See* Plate II.)

The Rico has been named and described from plants grown from seed obtained by the writer in 1911 from Mr. J. E. Higgins,

[1] Hughes, G., Natural History of Barbados, 1750, p. 204.

PLATE II.—FRUITING TWIG OF THE "RICO" ROSELLE.
(One-third natural size.)

PLATE III.—"VICTOR" ROSELLE ABOUT FIVE-SIXTHS NATURAL SIZE.
(From F. B. No. 307, U. S. D. A.)

horticulturist of the Hawaii Agricultural Experiment Station, and has probably descended from a variety grown in 1902 in the Agricultural Experiment Station, Mayaguez, Porto Rico, by Mr. O. W. Barrett, now chief of the division of experiment stations of this Bureau.

The white-fruited roselle is of a more upright-growing habit than the Victor or Rico, but is less vigorous than either. The calyces are very much smaller than those of the above named varieties and are whitish or straw colored.

SOIL, PLANTING AND CULTIVATION.

The roselle thrives in any soil that contains the plant food necessary for its development. The plant is of rapid growth and requires abundant moisture, although well-drained land is essential for its well being. It is very much subject to the root-knot nematode (*Heterodera radicicola*), and land infested with this pest should not be planted to roselle.

Before sowing the seed or setting out the plants in the field or garden, the land should be well cleared of weeds and plowed or spaded deeply—the plant having a more deep-going root system than most annual plants—and the ground well pulverized. The seed may be sown any time after February 1, but the planting should be done before May 25 in the Northern Hemisphere and before the corresponding time in the Southern, for the reason that if planted later the plants do not then have sufficient time to attain their proper development before fruiting. This is due to the fact that the roselle has the peculiarity of blooming and fruiting from late in September through the following fall and winter months, independently of the time of the sowing of the seed.

The writer found in south Florida that early sowings produced large plants; these, however, did not yield calyces quite as large as those grown from later sowings, for instance those planted about May 15, and it is probable that this will also prove true in the Philippines to some extent.

The seed may be sown thinly in a frame or seedbed, and the plants transplanted to the field when they are about 10 centimeters tall, or the land may be laid off and 4 to 6 seeds planted to each hill, the plants as they develop thinned to one plant to a hill. The latter plan is perhaps the best for the average grower. In sowing the seeds cover them lightly with soil. The thinnings may be used in resetting hills where the seed failed to germinate. The transplanting should be done preferably on a cloudy day or late in the afternoon. Before removing the plants from the seed bed, cut off nearly all the leaves and water the plants thor-

oughly; in transplanting make a small basin around each plant and water it well unless the soil is fairly well moistened or the work is performed during the rainy season. If the season is very dry it may be necessary to follow this up with a second and third watering, depending upon weather conditions. The roselle is readily propagated by means of cuttings, but this method of propagation, while of advantage to the plant breeder, is not recommended for the general grower.

In the field make the rows 1.5 to 3 meters apart, the plants being 1 to 2.5 meters apart in the row, depending upon the fertility of the land, supply of moisture and the time of the year when the seed is sown, the earlier sown seed being planted at the greater distances. If the object is to utilize the leaves and stems for sirup, jelly, etc., or if the plants are grown for fiber, the seed should be sown thinly in drills 60 to 100 centimeters apart.

During the early stages of the growth of the plants keep down the weeds by means of frequent and shallow cultivation; as soon as the plants have attained sufficient size and spread to shade the ground and choke out the weeds cultivation may be discontinued. If the plants are pruned to within 30 centimeters from the ground after the crop is gathered, they will form a new top and fruit again the next year; however, it is doubtful if this treatment is preferable to handling the roselle as an annual and making a new sowing each year.

HARVESTING AND YIELD.

As already noted a peculiarity of the roselle is, that no matter what time of the year the seed is planted in the Northern Hemisphere, the plant blooms late in September and October and the harvest of the calyces continues throughout November and December. The same is of course true for the corresponding months in the Southern Hemisphere. If the calyces are harvested promptly after attaining their full size, while the calyx stems are still so brittle and tender that they snap on breaking, the plants continue to bloom and calyces may then be gathered continuously even during the first months of the year, though they are not so large as those from the first bloom. The writer found in south Florida that the average yield of the Victor variety was 5.6 kilograms per plant from the first bloom; the second bloom yielded 1.7 kilograms, making a total of 7.3 kilograms. This variety, planted 2.5 by 3 meters apart, 1,300 plants to the hectare, would thus produce in round figures 9,500 kilograms of calyces per hectare if every plant bore its proper quota of fruit. In Hawaii a yield test of a variety obtained

from Porto Rico indicated a crop of from 6,750 to 7,875 kilograms per hectare. In south Florida the writer has had plants of the Victor variety under his personal observation that yielded over 10 kilograms of calyces per plant. At the Hawaii Agricultural Experiment Station the cost of gathering and packing the calyces has been estimated at about 4.5 centavos per kilogram.

COMPOSITION AND USES.

On account of the similar uses of the calyces of the roselle and the cranberry the following comparative analyses of the two fruits, quoted from Farmer's Bulletin No. 307, United States Department of Agriculture, may be of interest:

Comparative analyses of the composition of the roselle and the cranberry.[a]

	Roselle.	Cranberry.
	Per cent.	*Per cent.*
Water	88.91	88.53
Solids	11.09	11.47
Ash	0.89	0.25
Marc (insoluble matter)	6.67	4.60
Acid (as malic)	2.77	2.74
Reducing sugar as invert	.33	1.90
Sucrose	.03	.10
Benzoic acid	Absent.	Present.

[a] The weight of a calyx averages from 7 to 10 grams, of which about 50 per cent is refuse, consisting of the seedpod and the stem end of the calyx, which is cut away in removing the seedpod.

Roselle preserves.—Jam and sauce can, of course, be made from the calyces only, but jelly may be made, not only from the calyces, but from the leaves and tender stems. That made from the herbage, however, lacks the brilliant color and transparency that distinguishes the jelly made from the calyces, and jellies with more difficulty. Both the herbage and the calyces make an excellent table sirup that may also be used in making cooling drinks and sherbet. In the West Indies a wine is made from the calyces that is said to be almost the equal of champagne.

In the manufacture of jelly it is not necessary to remove the seedpods from the calyx, but this must be done in making sauce or jam. The seeding is done by cutting off the stem and basal end of the calyx and forcing out the seedpod through the apex. (See Fig. 1.)

Jelly is made from the calyces as follows:

Rinse the calyces well, put them in a saucepan of granite ware, or porcelain, with just enough water to cover the calyces, boil them until they are soft, strain the mass through a cloth bag, measure the juice and add an equal amount of sugar, liquid

measure, and boil until jelly is formed, which will be in from ten to twenty minutes.[1]

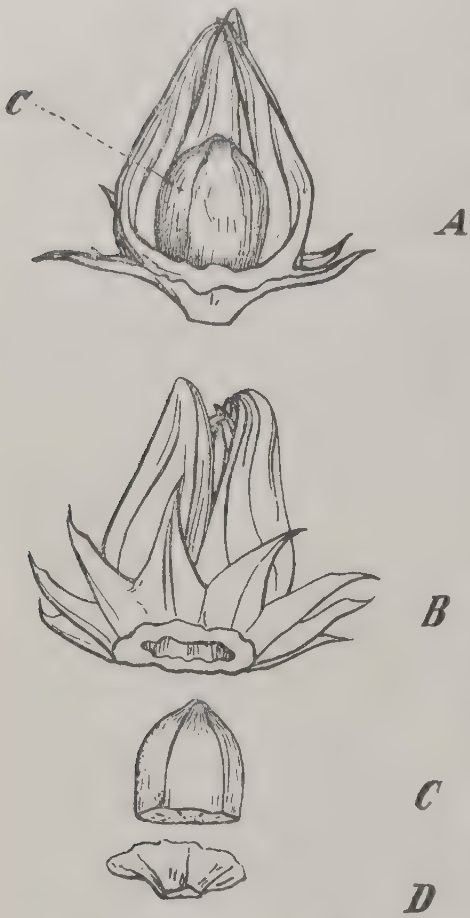


FIG. 1.—The "Fruit" of the Roselle, illustrating the edible part and the refuse: *A* calyx with two calyx lobes removed showing seedpod *C*; *B* calyx, the edible part, ready for cooking; the refuse, consisting of seedpod *C* and base of calyx *D*.

It is not necessary to remove the seedpods if the jelly is made from the calyces only.

After the juice has been strained off from the calyces, these may be made into jam or sauce. They should then be mashed, sugar added to taste, and the whole boiled for a few minutes. Prepared in this way the calyces are excellent for eating with meat, like cranberry sauce.

For making jelly from the herbage, cut the plants—well above ground so the stubble can readily sprout again—when they are about 50 to 60 centimeters tall. Rinse the plants thoroughly and cut the material sufficiently so as to allow it to go into the boiler easily; pour on boiling water until the stems are barely covered after they have wilted, and boil from three to five minutes; then pour off the juice, strain, measure, and return it to the boiler and boil until the juice is reduced to about one-third; then add sugar, liquid measure, equal to the amount of the juice *before its reduction,* and boil until jelly is formed, usually from five to ten minutes. If desired, lemon or lime juice may be added, one lemon to about 6 glasses of jelly.

Sirup is made according to the same formula, but the boiling is of shorter duration; mixed with water the sirup makes an excellent cooling drink and a good sherbet.

The following formula for making jelly from the leaves and stems, and the calyces, has been furnished by Mrs. C. M. Conner, Manila:

[1] Mr. J. E. Higgins of the Hawaii agricultural experiment station recommends that the juice be boiled for twenty minutes and the sugar then added, after first having been heated in the oven so that the boiling is not interrupted. About 1.8 kilograms of sugar and 4 kilograms of calyces are required to make one dozen 6-ounce jars of jelly.

After having rinsed and cut up the material as already described, add 1 liter of water to each 2 heaping liters of stems and leaves and boil for thirty or forty minutes and strain. To each liter of juice obtained add one-half liter of sugar and allow the sugar to be dissolved in the juice, then boil over a slow fire about twenty minutes, or until the sirup jellies. Do not stir the sirup in the act of boiling. Jelly from the calyces should be made according to the same directions.

In making jam from the calyces without first extracting the juice, Mrs. Conner recommends 1 liter of water to 4 liters of seeded calyces; sugar is added to taste.

Wine.—The following formula for making wine of the fruit of the white-fruited variety has been furnished by Mr. A. S. Archer, Antigua, British West Indies:

Remove the seedpods from the calyces, which, after having been rinsed in cold water, should be put into a stone jar; a metal jar will not do as the acid corrodes the metal and poisons the liquid. Fill the jar with calyces and press firmly, then pour on enough cold water to cover the calyces and leave to stand for eighteen hours. Pour off the liquid and sweeten it with best refined sugar, making it rather sweet. Pour the juice into bottles, placing two or three bruised cloves in each and leaving a few centimeters of air space in each. The corks should be well wired so that the gases that are generated during the fermentation do not force them out.

According to Mr. Archer the wine has the color of champagne and is almost equal to it in taste.

Another formula for making roselle wine has recently appeared in the Queensland Agricultural Journal, and is quoted verbatim:

Put your fruit into a cask that has one head out. Pour boiling water over the fruit, rather more than enough to cover it. Let this stand for about three days. Stir now and again. At the end of three days, strain the liquor into another cask, with both heads in. Then for every gallon[1] of liquor take three pounds[2] of sugar and make a good thick sirup of the same. Pour this into the liquor while hot, and stir well. Leave the cask with the bung out until fermentation starts. Should this not occur, say, within twenty-four hours, add a bottle of yeast. Keep the cask in as even a temperature as possible, as this will help fermentation. In the process of fermentation you will lose some of the liquor. Should it ferment thoroughly, save the liquor that overflows from the bung-hole, and put it back in the cask; but should you find this not enough to keep your cask full, add a little warm water. When the liquor has almost finished fermenting—say, when it stands at three degrees density by the saccharometer—bung up the cask and leave for three months. Then bottle.

When it is considered that the same elements that give flavor and color to the products made from the calyces are also present in the leaves and stems of the plant, it does not seem improbable

[1] One gallon=3.78 liters.

[2] Three pounds=1.35 kilograms.

but that the plant itself may also be utilized in making wine, as it is now being made into jelly and sirup.

Pottage.—The leaves of the roselle make very good "greens," better flavored than those made from turnips.

THE ROSELLE AS A FIBER PLANT.

In India the roselle is grown to some extent for its fiber, and its cultivation for this purpose might well be considered in the Philippines. If the roselle were grown on a large scale for the calyces, the stems, containing a strong fiber, might be utilized in the manufacture of paper, and thus be turned into a source of profit instead of being a waste and an expense to the grower in removing the plants for another crop.

DISEASES.

The only disease, so far, that has been noted on the roselle is a mildew (*Oidium* sp.) that was found in Florida to attack the plant in the fall with the approach of cool and damp nights. It is, however, easily controlled by dusting dry sulphur over the plants; this should be done early in the morning while the plants are still wet with dew. This disease has so far not appeared in the Philippines.

INSECT PESTS.

The most serious insect enemy of the roselle is the root-knot nematode (*Heterodera radicicola*). A cheap and effective remedy for this pest has not yet been found, and infested lands should not be planted with the roselle. This pest has not yet been reported from the Philippines. The cotton stainer (*Dysdercus suturellus*) has made its appearance on the ripening calyces of the plant both in Florida and the Philippines, but seems to be of minor importance. Aphids (*Aphis* spp.) that sometimes attack the young plants are readily controlled by the application of tobacco dust. Two scale insects (*Coccus hesperidum* and *Hemichionaspis aspidistræ*) have been recorded on the roselle, also a mealy bug (*Pseudococcus* sp.), neither, however, as serious pests.

THE PANDACAN FORAGE FACTORY.

By Z. K. Miller, *Machinery Expert.*

The equipment for the Pandacan forage factory was purchased and moved to the present location at the Pandacan quarantine station on the Pasig River during the early part of the year 1909. The machinery consisted of the following: One rotary, direct-heat, American-process dryer, 1.8 by 12 meters, together with furnace, blower fans, and other necessary accessories; one Williams patent alfalfa pulverizer and crusher with air separator; one Silver Creek heavy-duty sacker, together with line shaft, elevator and conveyors.

A factory building, 24 by 25.6 meters, was erected to house the machinery and for the storage and mixing of the raw materials into the finished product.

A warehouse, 11 by 18 meters, for extra storage facilities, was also erected near the factory building. All of the machinery, together with a 75-horsepower Westinghouse electric motor to furnish power for the plant, was installed and in operation by the first part of 1910.

Experiments in crushing and drying green forage crops were carried on for several months with corn, sorghum, Guinea grass, and several varieties of native grasses.

The dryer is a direct-heat type; that is, the gases from the furnace pass through the shell with the green product as the dryer rotates, the product being carried up on the angle plates and dropped down; this keeps the product in motion while the gases are passing through and driving off the moisture. The dryer was converted into an indirect-heat type by jacketing the shell and allowing the gases to circulate outside, a blast of hot air being forced through both shell and material, thus driving off the moisture. This made a very good dryer for experimental work. The raw material was run through the pulverizer to reduce it to particles as small as ordinary short-cut hay or straw; this was for the purpose of making the material dry easily and uniformly. The results obtained were unsatisfactory, and the

expense of curing with this type of dryer was excessive, amounting to nearly the full value of the finished product.

The drying of forage crops by artificial heat has been stopped temporarily until a more economical dryer can be obtained, and tentative plans have been drawn up for an entirely different type. Experiments now carried on in the United States with a somewhat similar type have been very successful and indicate that a satisfactory and economical dryer will be in operation in the near future. It is earnestly desired that funds be provided for the erection of a small experimental model of this type, so that this phase of the forage question may be more thoroughly investigated.

In these Islands the drying of forage crops by artificial means is an almost absolute necessity, and will remain so until irrigation systems have been established throughout the farming districts. The reason for this is that with irrigation these crops could be grown during the dry season while at present the bulk of the forage crops grow and mature during the wet months (approximately six months of each year), and during this time it is almost impossible to dry them by natural means. The growth is heavy and requires to dry about double the time ordinarily required in a temperate zone. The ground is so damp, and the dews are so heavy that the crop must be turned over several times; thus before it is cured it turns black and musty, and has lost its sweetness and feeding value.

A successful dryer will make it possible to convert the raw material into an excellent and wholesome finished product retaining all of its nutritious qualities; this can then be baled and stored for use during the season that no crops are produced.

GRASS AND GRAIN-RATION EXPERIMENTS.

A Nordyke and Marmon French buhr grinding mill, with a corn- and cob-crusher attachment, was installed to grind corn, beans, peas, etc., and experiments were commenced for producing a satisfactory grain ration containing the largest possible percentage of native-grown products, to be a substitute for the imported ration of oats and other crushed foods. Every kind of grain possible to obtain was experimented with, and balanced rations of these crushed grains and dried-forage roughage were made up and furnished the Army, the city stables, and the Bureau of Agriculture experiment stations for testing. These mixtures were principally dried grasses, ground corn, and ground Shanghai beans, mixed in such quantities as would give a complete balanced ration, similar to those imported.

The Army and the city both reported adversely, stating that the stock would not eat it. This might have been due to the fact that there is always a certain amount of prejudice among stock feeders against trying anything new, and to the fact that bean meal and artificially dried grass have an odor and taste slightly different from ordinary feed, thus causing animals to dislike them at first. Better results were obtained from tests at the Bureau stations, where, instead of the animals being placed entirely upon this ration at once, small quantities were added to their usual feed; this amount was gradually increased, and the ordinary feed decreased, until the animals were eating nothing but the new ration. They did not seem to notice the change except in a few cases, and they appeared to thrive as well on the new ration as on the old. One lot of this mixture that was returned to the Bureau, rejected with the claim that the stock would not eat it, was consumed by the Bureau stock with apparent relish, even after it had been stored long enough to become full of weevils. The stock were not starved to make them eat it, and their condition compared favorably with that of the other animals. One of the principal difficulties found was that the presence of corn in the mixture attracted a large number of weevils, especially when kept stored for any length of time.

GRAIN RATION TEST.

With the suspension of drying, attention was given to producing a crushed-grain ration that would have a composition about equal to that of oats. A ration composed of crushed shelled corn, Shanghai beans, and wheat bran was produced, and it has given complete satisfaction; three-fifths of this ration is corn. It has been used by the Bureau stations for a period of two years, more than one year by the city, and the Army has used 50 tons in making tests. There is no question but that the feeding qualities are equal to those of any imported grains. Last year about 700 tons, valued at ₱50,000, were made up and fed to stock; the condition of the animals was as good as that of those fed on imported grain, and in the case of the older stock, much better. This was concurred in by the forage board, which made exhaustive comparative tests with grain rations, and proves that corn can be, and is, an excellent substitute for at least 40 per cent of oats and imported grain rations. (See the Forage Number of the PHILIPPINE AGRICULTURAL REVIEW, August, 1911, p. 465.) As proved by the Bureau in feeding this ration for a period of two years to practically all

the animals that it owns, corn could be substituted to the extent of even 60 per cent. Crushed corn and cob meal instead of the corn meal mentioned before make a better grain ration for cattle and carabao, where an extra amount of roughage is required. The superintendent of the serum laboratory at Alabang, after exhaustive feeding tests covering an extended period, states that better results were obtained in feeding carabao with this ration than with any other imported or native feed.

EXPERIMENTS IN STORING CORN.

The process of handling corn in these Islands is as follows: When the corn is matured it is taken off the stalk, and the husks stripped back and tied to other ears, making a circular bundle of about 50; this is kept in a shed or under the house, and when the sun is shining is carried out and left to dry, being returned to the shed in case of rain or at night; when the corn is dry enough it is taken to market by train or banca. The corn for local consumption is sold in small lots only, and care must be taken to store it where air will circulate freely, or the grain will mold. At the forage factory all new corn is bought in the ear, cleanly husked; it is weighed and placed on a dry concrete floor to a depth of 45 or 50 centimeters, depending on the greenness of the corn; when this is fairly well dried out, more corn is added, to a depth of from 15 to 30 centimeters; this process is repeated until the corn is 1.8 or 2.1 meters deep. If care has been taken in allowing the corn to dry out before new corn is added, it will not heat, mold, or rot. On the other hand, if corn is added too fast or air does not circulate freely, the corn will heat and spoil. The majority of corn coming to this factory is brought in loosely in box cars. If the corn is not shipped or unloaded promptly, as has been the case on one or two occasions on account of typhoons, it is found to be quite hot when taken from the cars, and has to be spread out very thinly to prevent loss. After a period of from six weeks to two months the corn is ready to shell and mill. At this period the weevils bore into the corn in great numbers, eat out the hearts of the grains, and propagate their young therein; it is almost inconceivable the rapidity with which these insects multiply, until the entire pile of corn is one mass of crawling insects.

The experiments conducted to destroy this pest and preserve the corn were as follows: A bin 3.3 meters square and 5.1 meters high was constructed and lined with building paper. The capacity of this bin was about 40 tons of dry shelled corn. The corn was not placed in the bin until after the weevils had attacked it, and when the corn was fairly alive the bin was

filled up; a dry bamboo opened along one side and about 3.6 meters in length was inserted into the center of the bin through the small opening in the top; 1.8 liters of carbon bisulphate was emptied into a tray near this opening and an equal amount poured down the bamboo tube, then the opening was closed up; in two weeks time a similar dose of 4.7 liters was poured in; this destroyed all the weevils, and the corn kept in perfect condition for about six months, when it was taken out and ground up. This demonstrated conclusively that weevils can be quickly destroyed and that corn can be stored in a large bin for an indefinite period with absolute safety.

EXPERIMENTS WITH DRYING CORN.

As stated before, the corn received is as a rule green and too damp to store. Recently the need of dry corn for grinding caused some experiments to be made. Five-centimeter steam pipes were laid 60 centimeters apart and 10 centimeters above the floor of a room 6.7 by 10 meters square. Ear corn to a depth of 1.2 meters was piled around and above these pipes, steam was turned on, and in one week's time the corn was ready to grind.

Another experiment was made in drying corn in a bin 3.3 meters square; 5-centimeter pipes were laid 30 centimeters apart on a cement floor, and ear corn to a depth of 3.6 meters was placed in the bin. This corn was very wet, and as there was no free circulation of air, the top part commenced to heat; 1.5 meters of the corn was then removed, allowing 2.1 meters to remain, and this dried out very quickly. These experiments have proved that corn can be successfully cured and stored in a bin without any loss from mold, rats, and weevils.

DRYING AND STORAGE TANK.

The following is a description of a design for a 50-ton tank for handling corn in large quantities. It is in the form of a circular iron shell, 3.6 meters in diameter and 5 meters deep, resting on a concrete floor. The shell would be constructed of sheet iron, 7.9 millimeters thick for the lower half, and 6.1 millimeters thick for the upper half; in the top there would be two doors for ventilation and for filling the shell with corn. There would be a discharge door at the bottom 60 by 90 centimeters and steam pipes laid over the entire floor space in concrete trenches 30 centimeters apart. These trenches would be covered with a strong iron grating set flush with the floor, the perforations fine enough to keep the shelled corn from falling into the trench; air could be forced in and around through

the bottom of the tank in the same trenches with the steam pipes. There would be but one trench leading into the tank, the steam to be discharged through a small outlet valve as the pipe leaves the tank; this would regulate the amount of steam passing through and drain off the moisture. The warm air, after entering the tank, would filter through the grating over the bottom, and as it rose would help carry off the moisture through the openings in the top. Ear corn should be dropped into the tank from the top to a depth of 1.5 or 1.8 meters; as this became dry, more corn should be added from time to time until the tank is full. After the corn is thoroughly dry the door at the bottom would be opened, the corn rolling out upon a conveyor that would carry it to the sheller; the shelled corn would then be elevated and placed in a tank like the one already described. The heating process would entirely free the corn from weevils.

For the purpose of ventilation and the diffusion of insect-destroying gases and for taking the temperature of the corn, six 5-centimeter pipes drilled with holes too small to permit the entrance of grains of corn would be placed at regular intervals in a vertical position throughout the tank at the bottom adjacent to the trenches and extending up to and through the top of the solid part of the tank; these pipes would have two sets of caps, one solid to screw on when it is desired to make the tank air tight to destroy insects, the other one perforated or covered with fine gauze to allow ventilation but to prevent the entrance of weevils. The entrance conduit at the bottom of the tank would also be covered with gauze to prevent insects from entering. Gas could be introduced either at the bottom or top, the doors being hermetically sealed with some solid grease placed along their joints. One of the important points is that the tops of the vent pipes could be taken off and a thermometer lowered into any part of the tank; thus in case some corn had been placed in the tank before being thoroughly dry, and had commenced to heat, it could easily be detected, and a blast of cool air could be forced into the tank. If this did not stop the heating, then the corn could be slowly removed by conveyor and elevator into another tank, and thus aired out. A battery of these tanks could be placed in double rows with conveyor above and between them slightly lower than the tank floors, thus handling the corn from the time it leaves the scales until it passes into the sack from the grinders. This would mean a minimum amount of mechanical labor only, and would prevent any loss by weevils, rats, or other pests.

ECONOMICAL VALUE.

Last year about 600 tons of ear corn were purchased and converted into stock feed, and in the past five months over 300 tons were purchased and ground into feed. The price of this corn delivered at the factory was from ₱45 to ₱48 per 1,000 kilos; this creates a market for a farm product that can be grown almost every month in the year, with very little capital, and means the leaving of this money among the farmers instead of sending it out of the country. This should stimulate the growing of larger areas of corn, since this Bureau will guarantee to take every ear of corn that can be delivered to this factory at the prices mentioned, until such a time as the output will supply the demand for stock feed. The amount consumed annually of this home-grown product will be more than ₱2,000,000, according to the figures given out by the forage board. The Army alone can consume 5,000 tons of cracked corn, as corn can be kept for an indefinite period in storage tanks and ground up and sent out in sufficient quantities to last for from ten days to one month as needed. By this method weevils will not infest the feed before it can be consumed.

CORN-BLADE FODDER.

The ear corn is not the only valuable product in corn raising. Corn-blade fodder has been demonstrated for many years to be an excellent substitute for hay, grass, and other forage roughage. At the present time practically all of this valuable product is thrown away, very little effort being made to cure and save it for stock food. One of the principal reasons for this is the excessive cost of transportation and the primitive method of tying it up in bundles or bales. Much instruction has been given by Bureau of Agriculture employees in regard to the best method of cutting, curing, and sending to market native grasses and corn-blade fodder; both horse and steam balers have been sent into Laguna Province to demonstrate this process; a few farmers have taken hold of the work and prepared some of the fodder, shipping it to this factory, where a standing offer at a very fair price is made for all that can be produced. One of the chief difficulties, aside from transportation, seems to be the lack of knowledge on the part of native farmers in regard to properly curing roughage of any kind. A vigorous campaign along these lines will need to be instituted to teach the farmer this process, and when a sufficient amount of fodder has been collected in one vicinity, a modern baler should be taken there, and the crop

bought up, baled, and shipped to Manila. A campaign of this kind for one or two seasons will convince the farmer of the value of his corn-blade fodder, will result in larger areas being planted to corn, and will tend to relieve the wants of people when the rice crop has been a failure as at the present time. Modern balers are not very expensive, costing about ₱500, and when this business is once well under way it will take care of itself.

REPAIR SHOP.

In connection with the forage factory a repair shop has been established where the automobiles, motorcycles, bicycles, farm and other machinery belonging to the Bureau of Agriculture are repaired more expeditiously and at about one-half the cost of the same work in other shops. A small modern copra dryer has been planned and is under construction at the present time. This will be ready for trial in a short time and is expected to greatly revolutionize the copra industry. Small-model, air-tight grain-storage tanks, suitable for farmers' use, to preserve seed corn and other grains from the ravages of rats, weevils, and other pests, have been planned, and are now under construction.

SUMMARY.

The forage factory represents the beginning of a campaign along the following lines: To get our stock feeds from home-grown products raised by our own farmers; to establish a market for these products; to solve problems in the art of storing grains so that they will keep in perfect condition; and to turn these grains into meal that would go far toward relieving the food situation in case of calamities. (A large amount of good, fresh, wholesome corn meal has already been supplied for human consumption, and the demand for this meal is daily increasing.)

The first cost of procuring these products was rather excessive, and is still high, but as more is produced and competition increases, prices will gradually go lower, until the home-grown products will be able to compete more successfully with those imported.

Additional machinery has been installed, including an 80-horsepower steam boiler and a 50-horsepower steam engine to take the place of the electric motor so useful in experimental work. The corn cobs now furnish a large part of the fuel for running the plant. With the new sheller, grinder, crushers, and storage tanks that will be installed, the factory will be well equipped to handle 30 to 40 tons of finished product per day. Every-

thing in connection with this forage-making business will be vigorously pushed along, until it has been firmly established throughout these Islands. A business amounting to ₱50,000 was done last year, and sales to the amount of ₱100,000 are expected this year. The figures should reach ₱200,000 next year, increasing until the ₱2,000,000 that go out of these Islands each year for stock foods will be kept at home and go into the pockets of the farmers. This means that there will be dozens of forage factories in the Islands, instead of one, as at present.

A NEW COCONUT PEST.

By D. B. MACKIE, *Agricultural Inspector.*

A parasite of the coconut palm which may prove to be the most serious pest of this crop in the Philippine Islands was discovered in May, 1911. This insect is related to the White Fly of the citrus orchards of Florida, and this fact alone is sufficient to cause the coconut planters considerable anxiety. For the present, however, it appears that this insect, which may be termed the Coconut White Fly, is confined to a district in Negros Oriental, extending from the barrio of Tabon on the north and the barrio of Zamora on the south, a range of some 35 kilometers in length. Most of the coconut groves in this area, which extends from the seacoast back to a range of hills to the west, are infested with the parasite.

The first specimens were collected on the hacienda of Mr. Henry Gardner in the vicinity of Guijulngan. It appears that this is the first occurrence of any insect of this genus in the Philippine Islands, and, furthermore, the species itself is new to science. It has been described by Mr. Quaintance of the Bureau of Entomology, United States Department of Agriculture, Washington, D. C., as *Aleyrodicus destructor*. A similar species (*A. cocois* Westw.) occurs in the West Indies and has caused immense damage there to the coconut groves, some districts having even been abandoned largely on account of its attacks.

Like all of the so-called "White Flies" (which are, of course, not flies) and the related "scales," the individuals are very small and not readily noticeable except when present in large colonies. The general color of the older individuals is white or grayish; at first the larvæ are nearly naked and of a pale brownish shade, but when about half-grown they develop a fringe of white waxy material around the edge of the body. This waxy substance, as the insect grows, gradually covers the entire body with a mass of cottony thread-like appendages and waxy flakes.

The minute eggs are laid on the under surfaces of the leaflets, usually on the young leaves of the palm. Thus far it appears the insect is attacking by preference only the young palms, that is, those under 6 or 8 years of age, but unless

Fig. 2.—Mature insect.
Length, 2½ mm.

Fig. 1.—Coconut leaflet showing typical colony of insects.

Plate IV.—A NEW COCONUT PEST (*Aleyrodicus destructor* Quaint).

checked it will probably soon spread to all the palms in the vicinity.

Soon after the eggs are hatched the young insect begins walking about on the underside of the leaf in the endeavor to find a suitable position for its attack; satisfying itself as to location, it inserts its beak through the epidermis of the leaf and begins to suck the sap from the soft inside tissue; after becoming thus attached, the young insect seldom moves, unless disturbed, until it attains its full size. Shortly before emerging as a winged insect it stops feeding, but remains attached to the leaf. Though comparatively weak fliers, the danger of their passing through the air from one tree to another is greatly increased by the action of winds, since when the insect may only wish to fly from one leaf to another it may be accidentally borne by the wind to a considerable distance.

Some of the colonies contain scarcely more than a dozen individuals, while others contain many thousands and form an irregular white area over the underside of the leaf. This feature of their color is exceedingly valuable to the coconut planter, since it allows him to readily determine the presence of a colony in his grove.

Although a hymenopterous insect, evidently a parasite of this coconut pest, was observed in the act of laying eggs in or upon the immature White Flies, it is not likely that any natural parasites will be of much avail in checking the spread of this pest. Therefore the coconut planters in the infested district should immediately go through their groves, cutting off and burning all attacked leaves, or portions thereof, and, by the same token, it would be well for all coconut planters to carefully look over their young groves, and if any white insects are discovered they should report the fact at once to the Director of Agriculture and should remove and burn all traces of the parasite. In certain cases it might be advisable to treat the pest with kerosene emulsion, or some similar spray, but unless the grower has had experience with such remedies, the use thereof would probably be in vain, if not actually injurious to the tree itself. Fumigation could be recommended only for extreme cases and then only for young trees.

If this pest is taken in hand immediately, there is very little chance of its spreading to other districts of the Philippines; and it is earnestly hoped that coconut planters throughout the Visayas and Tayabas will make a strenuous effort to prevent the spread of this pest, which, although apparently new to these Islands, may within a few years become an exceedingly important factor in the coconut industry of the Far East.

ANIMAL DISEASES IN FORMOSA.

By Dr. John D. Reardon.

In accordance with instructions contained in a telegram received at Baliuag on December 26, 1911, I embarked December 27 on the steamer *Spir* bound for the port of Takow, Formosa, for the purpose of examining certain animals bought by Mr. Eugenio Evangelista, and which were intended for shipment to the Philippine Islands.

I arrived at Takow on December 31, 1911, and immediately upon arrival examined the animals above mentioned, all of which appeared to be in good health.

On January 1, 1912, I proceeded to Taihoku, the capital city of Formosa, and presented my credentials to Mr. Reed, the American consul. He informed me that all government offices were closed from December 28, 1911, to January 5, 1912, but that it might be possible to obtain a special interview before January 5 with the minister of foreign affairs or the chief veterinarian, if the matter was important.

On January 3 I succeeded in obtaining an interview with Mr. Moesha, minister of foreign affairs, and, although he gave me much valuable general information, he explained that more specific data could be furnished by Doctor Osaki, chief veterinarian. As Doctor Osaki was absent from the capital, I was obliged to wait until his return next day, when he gave me the following information:

Only about 40 per cent of the Island of Formosa is under direct control of the Japanese. The rest of the island is inhabited by wild tribes (aborigines), who are kept from encroaching by a large metal fence. This fence is charged with electricity at all times so that certain death is the fate of the man or animal that attempts to cross it. For this reason this district, largely mountainous, is not considered in this report as it is completely isolated from the part governed by the Japanese.

The civilized portion of the island is divided into 10 prefec-

tures (provinces). Of this number only one prefecture (Ako) is at the present time infected with rinderpest, although surra and splenic fever are more or less prevalent throughout the island. As I was most concerned regarding the prevalence of rinderpest and foot-and-mouth disease, these were the principal objects of my inquiries.

Doctor Osaki informed me that foot-and-mouth disease was unknown in the Island of Formosa. Cases of suspected rinderpest had been found in the prefecture of Kagi during July, 1911, but no cases had been discovered since that date.

The prefecture of Ako had always been more or less infected with rinderpest, but on July 10, 1911, for some unknown reason, it broke out in a very virulent form, 2,100 cases having been diagnosed since that date.

At present the disease seems to be decreasing, about 30 cases having occurred in the week previous to January 1, 1912. Ako is about 42 square miles in area. At this date there is a force of 30 Imperial veterinarians, 50 Imperial police, and hundreds of coolies fighting rinderpest in this prefecture.

The following is the method of combating rinderpest:

When a case of disease is discovered by an owner or local official it is at once reported to the nearest government veterinarian; if the disease is diagnosed by the veterinarian as rinderpest or a suspect, the animal is at once condemned, killed, and the carcass is cremated and buried; the ground in the immediate vicinity is thoroughly disinfected; all animals in direct contact are isolated for ten days, tied up and injected with from 40 to 60 cubic centimeters of antirinderpest serum; all animals within a radius of approximately one-quarter of a mile are isolated for twenty days.

After the quarantine period mentioned above animals are allowed to work, but they can not leave the farm or small restricted district for another district while disease prevails in a prefecture.

Penalty for infraction of above-mentioned quarantine laws:

The penalty for infraction of any of the quarantine regulations is not to exceed 100 yen (₱100), or flogging, one lash of the whip to correspond to 1 yen. Infractions are generally punished by a fine of 5 to 40 yen or a similar number of lashes. This measure was instituted December 1, 1905, and since that date 5,400 people have been penalized. In Ako for the last year there have been only twenty or thirty known infractions of the quarantine law; in every case the infraction consisted of failure to report disease promptly; there have been no known cases in

Ako where people have broken the law in regard to movements of animals.

I was informed by Doctor Osaki that the census is very complete, local officials reporting daily changes in the census through death or birth to the veterinarian in charge of the prefecture, the veterinarian in charge in turn reporting daily to the chief veterinarian.

If the above-described procedure is faithfully and intelligently carried out, it would seem that the danger of rinderpest spreading in Formosa is reduced to a minimum, and that the chances for eradication are good.

It is safe to assume that animals free from rinderpest can be imported into the Philippine Islands from Formosa, provided that the Japanese veterinarian in charge of the prefecture where animals are purchased issue a health certificate covering said animals and that these animals be held in quarantine after arrival in the Philippines for such time as may be necessary to complete a period of ten days from date of embarkation.

AGRICULTURE IN THE CUYOS ISLANDS.

By Elmer H. Bahr.

This diminutive archipelago is located about halfway between the Island of Panay and the northern end of Palawan; that is, they are directly south of Mindoro and, though widely separated therefrom, really belong to the Busuanga-Culion-Palawan group.

The group consists of about 20 inhabited islands; many of these are inaccessible by small boats during most of the year; by far the largest is Cuyo Island. All the islands are comparatively level, though the center of each usually has a low hill or rocky prominence. With exception of the typhoons, which occasionally visit this group, the climate is excellent. Droughts are, of course, rather serious because of there being no mountains near enough to affect the rainfall. There being no swamps and very few "esteros," mosquitoes consequently cause very little trouble. The soil is usually a reddish loam or loamy clay and is well adapted to ordinary crops, such as maize, upland rice, sorghum, beans, etc. Fruits could be easily grown, and in fact there are a considerable number of oranges, tangerines, lemons, mangos, etc., in evidence.

Most of the trade of the Cuyos is with Culion and Iloilo, small sailing vessels and a regular line of steamers readily handling the small amount of goods.

The islands have been settled for about three centuries. According to current report the first white man to settle in Cuyo was a count who had been banished from Spain on account of some real or fancied grievance with the Crown. His manner pleased the native chief of the islands, who gave his daughter in marriage to the count. Wishing to show his appreciation of the nobleman's honorable presence and earnest intentions, the old chief urged his people to adopt the white man's religion, and this idea was promptly carried out by the subjects of the chief. In 1626 the present church and fortress were built. The inhabitants of the group are, of course, Visayans, though, on account

of their isolation, it appears there are some slight differences in dialect, customs, etc., between the Cuyoanos and the other branches of that race. The number of inhabitants is estimated at 12,000.

The general health of the people seems to be good, though there is noted the same lack of variety in diet and proper nutrition that is so deplorably evident among the poorer classes in other districts.

Wages are low, the men receiving but 20 centavos per day, with their dinner and a glass of tuba; the women and children receive about 15 centavos per day without food.

The principal crops are cassava, maize, rice, sweet potatoes, ubi, and a few beans. Cassava, or "camoting cahoy," is used to a very large extent as food by the common people. The method of cooking is as follows: The tubers, from 3 to 5 centimeters in diameter and from 30 to 70 centimeters in length, are peeled, cut into pieces about 3 centimeters long, and dried in the sun; when wanted for use these chips are pulverized in a wooden mortar and then slowly boiled for a long time, until a stiff pasty dough, resembling that of rye bread, is produced. This is eaten as a mush, or thick gruel. This food, with rice and sweet potatoes, forms the principal diet of the inhabitants. Some very superior upland rice is grown in the islands, but there does not seem to be a proper interest taken in the selection of varieties or in breeding up strains. Coconuts are fairly plentiful, but a very large proportion of the trees are used in the production of tuba. In fact, it appears that altogether too much tuba, for the good of the people, is consumed. On the other hand, copra is not very profitable on account of expensive transportation and limited areas of trees planted in any given locality.

It has been believed that the Cuyos orange is, or will be, a rival of the "naranjita" of Batangas Province, and in point of fact the former is an excellent fruit, though it is not produced in very large quantities. Most of the orange crop is exported to Culion or Panay, very few of these fruits finding their way to Manila. Mangos abound throughout the islands, and both these and the citrus trees appear to suffer considerably from insect pests. The breadfruit, jak, various anonas, papayas, bananas, and a few pineapples are grown for local consumption. Bananas retail at about 15 centavos per bunch, oranges for about 50 centavos per hundred, and mangos for 75 centavos per hundred.

All the land is either under cultivation or in pasture, there

being no forests whatever; with exception of bamboo there is hardly enough timber for the necessary firewood. Most of the land holdings range from one-quarter to 6 or 8 hectares. When land is for sale it can be had at about ₱15 per acre. Unless some forage plant can be grown for feeding during the dry season the islands can not support any more live stock than is in evidence at present.

There are, in round numbers, about 700 carabaos, about the same number of cattle, and about 100 head of horses. The original stock of cattle came from Antique Province, and, in consequence of inbreeding and lack of sufficient forage, these animals have deteriorated somewhat. Both with the cattle and the horses the custom prevails of exporting practically all of the salable males and, with this bad feature of the case and with practically no attempt to introduce improved sires, the domestic animals of the Cuyos are considerably below the average. According to report, Cuyos has never had an epizoötic among the live stock. The introduction of a few good pigs would result in much benefit. Sheep and goats are very scarce. During the dry season there are practically no running streams even on the large island of Cuyos. Wells are few and on account of the soil being usually porous it is necessary to dig down to about sea level in whatever locality the well may be located. High winds are liable to occur at all seasons of the year. The harbors are few and badly sheltered. There is usually a wide strip of shallow water near the coast, making the discharge of cargo expensive and dangerous. At Cuyo, however, a causeway has been built out into the bay which was expected to greatly improve matters, but unfortunately this causeway is said to have had the effect of shoaling the harbor somewhat.

It would seem that the Cuyos are due to *receive* more than to *give* from the agricultural standpoint, and it appears that the only worthy article which the Cuyos can offer to the other islands of the Philippines is the famous Cuyo orange, or cajel. This orange promises to be one of the most popular citrus fruits of the Philippines. Its size is good, the average weight being some 220 grams. The quality is fair and would probably be better if the trees were properly pruned and cared for. Its flavor and aroma are fully up to the average orange and while, of course, not a navel, nor a high-grade horticultural hybrid, it is fairly free from seed and the coarse "rag" so common in many of the Philippine citrus fruits. Budwood of this variety has been brought to Manila and the buds are now growing at the Lamao experiment station.

CURRENT NOTES[1]—MARCH.

CROP ROTATION IN CHINA.

In view of the interest which has recently developed in crop rotation in the Philippines, the following quotation from notes taken by Mr. C. V. Piper, on his visit to Canton, China, and sent in to the United States Department of Agriculture at Washington, D. C., may be of some value:

At the western end of the city of Canton is an extensive area of flat swamp lands which have been utilized by the Chinese in a highly developed system of water gardens. The land has been divided in small paddies of an acre or so, usually less, each surrounded by a dyke. These paddies are always covered with water, usually 1 or 2 feet deep. Five different crops are grown in regular rotation, namely, lotus (*Nelumbium speciosum*), Chekoo (*Sagittaria chinensis*), Kausun (*Zizania*), water chestnut (*Eleocharis tuberosa?*), and Lingkok (*Trapa bicornis*). A sixth crop also occurs, Ongchog (*Ipomoea reptans*), but this, as I understand, does not enter into rotation, whole paddies or parts of them being devoted constantly to this plant. At the present season (July 10, 1911) the principal crops are lotus and Trapa, but these are being harvested and in a few cases the harvest completed. At the edge of most paddies is a row of Kausun or of Sagittaria, or both, to be used as "seed." As soon as the lotus is harvested the paddy is planted to Kausun. The seed plants of this are now about 6 feet out of the water. In transplanting this is cut off to 2 or 3 feet, the tufts separated into parts of about 3 culms each, and planted in rows 4 feet wide, the plants about 2 feet apart in the rows. One mother plant I had dug up had a single stolon 2 feet long about as large as a lead pencil, the joints 2 to 3 inches long. From the crop now being planted the crop will be obtained in about two months.

Trapa is planted from the seeds in the spring; water chestnuts from the corms in the fall; and Sagittaria from the roots, also in the fall. Lotus yields both a crop of rootstocks, resembling a string of large sausages, and the pods, both of which are now in the market in abundance. Another variety is grown only for the flowers. This information is the best I could get except in the case of Kausun, of which I saw new paddies just planted. Most of the Kausun planting will be in about two weeks.

The dykes between the paddies are often planted to trees, especially loongan and leitchee. On the edges of the dykes one frequently sees taro (*Colocasia*). The Chinese all say the Kausun does not produce seed, which is probably true as they cultivate it.

[1] Original notes prepared by various members of the Bureau of Agriculture.

Besides these crops the Chinese secure an abundance of snails and frogs from the paddies. In some there are fish also, but the fish ponds are usually separate as are the duck ponds. On the surface of the paddies is a solid mat of Azolla and two species of Lemna which are gathered in great baskets as food for ducks and fishes. * * *

The gardens are excellently kept and no doubt are very profitable. It certainly is a wonderful way of utilizing what otherwise would be waste land, and indicates one method we might copy in utilizing some of our swamp areas. Indeed, it seems to me a swamp experiment station would be well worth while even now.

I saw no mosquitoes, and they are said not to be bad, due no doubt to the fishes in the ponds at least in part.

NEW RICES.

A number of new rices have just been discovered in Chinese Turkestan by Mr. Frank N. Meyer, agricultural explorer of the United States Department of Agriculture. Some of these types grow well in alkaline soils, and one is said to ripen seeds in ten weeks from date of sowing. Other things being equal, the Philippine planter could harvest *five crops in the same field each year* by planting this special variety.

PASTURE LEGUMES.

Prof. C. V. Piper has recently discovered three new pasture legumes in British India. One of these is related to the mani-maníhan, another is a kind of wild indigo, and a third appears to have no close relatives in our flora. The great advantage in legume grazing crops is in the fact that, unlike grasses, they do not tend to impoverish the soil. Furthermore they can be grown on poorer soils than grasses, other things being equal, because they are able to obtain practically all of their own nitrogen through the nitrogen-gathering bacteria of the nodules on their roots. The last word has not yet been said on cover crops; when the farmer can plant a crop in his coconut or abacá plantation, which will not only keep the sun from injuring the surface soil and plant roots therein and which will supply nitrogen to the soil itself, but one which will at the same time furnish a first-class forage, either for grazing or for hay, then we may expect a great revolution in modern agricultural methods, and the planter will "come into his own."

NEW BANANA FOOD INDUSTRIES.

Two new banana food companies have recently begun operations in the Island of Jamaica, British West Indies. The success in the manufacture of banana "figs," or dried bananas, has attracted considerable attention, and, as a result, other products

are now to be turned out. One of the new articles will be banana "chips," a new and very nutritious breakfast food; this is already fairly well known in England and Germany. Banana meal, which can also be used either as a breakfast food or as a "thickening" for sauces, soups, etc., has come into the market to stay. It is said the demand is rapidly increasing for all kinds of banana products. The source of the material for these products is the small or over-ripe bunches discarded at the dock in loading the fruit steamers for the United States and Europe. Bunches having less than 6 "hands" are considered too small for the regular trade; any bunch showing even a few fruits that are beginning to turn yellow are also discarded in the warehouse at the time of loading the cargo. The writer has seen this deplorable waste of material at Port Morant, in Eastern Jamaica, where the United Fruit Company has one of its largest plantations; bunches are flung overboard, or fed to the cart oxen, with apparently no thought for the real food value of the fruit.

The time is probably not far distant when we shall see banana product factories running briskly at various points in the Archipelago. In this connection we should remember that the statement made long ago by Humboldt, as to bananas being capable of producing more human food per acre with good cultivation than any other known plant, still stands, though the truth of this statement has at times been questioned. The trouble in the past, of course, has been that bananas and plantains do not keep well unless dried by special processes and do not endure long storage without losing some of their flavor, at least, if not some of their nutritious value. The advent of the new vacuum driers changes the entire commercial aspect of the banana-products industry, and we shall soon see a great variety of food products made from the 200 or more banana varieties. There is enough waste ground adapted to banana culture in the Philippines to-day to supply a large portion of the food of 25,000,000 people, if the new methods of handling that wonderful crop were put into operation.

NEW USES FOR BANANAS.

For a number of years certain kinds of bananas and plantains have been used, especially in tropical America, in the production of a highly nutritious flour. This flour is very easily digested and may be given to children and invalids with safety, notwithstanding the fact that its feeding value is considerably higher than that of the cereal flours.

Banana "figs" have recently become an article of commerce, but outside of confectionery merchants they are still looked

upon with some doubt. These dried bananas are a highly concentrated form of nourishment and, although put up without being sweetened or flavored in any way, are very appetizing and at least some varieties of bananas retain their flavor in this condition fairly well.

Although new foods and drinks usually have a long "probation period" in coming into popular favor, it is probable that if banana coffee could be properly advertised and handled by reliable firms, there would be no question about that article "taking" at once. It is made by partially roasting half-ripe fruits of some type, like the plantains, and then grinding to the desired fineness. The aroma from "coffee" made this way is as delightful as the beverage itself.

In this connection it should be remembered that while scarcely 25 kinds of bananas are in evidence in the Philippines, there are now known some 200 varieties belonging to at least 20 species scattered throughout tropical Africa, Asia, and the islands of the Indian and Pacific Oceans; *i. e.*, we have 175 to get.

The latest use for overripe, surplus, and unsalable bananas is in the preparation of a kind of wine. This has recently been put into practice by MM. Guerin and d'Héerille in Saigon, Cochin China. It appears the bananas are crushed, mixed with a small amount of water, and then, upon the addition of yeast, allowed to ferment until the starch and sugar are changed to alcohol. The wine, "besides being much cheaper than ordinary spirits, is said to have a delicious perfume."

While the Philippines already have one of the cheapest wines (nipa "bino") in the world, there would undoubtedly be a market here for banana wines, as well as coffees and flours. If even 5 per cent of the area now in abacá were planted with bananas the Islands could easily establish a trio of promising industries from these products.

COCONUT-OIL TRADE.

Marseille has long held the position of the chief oil city of the world, but it is only recently that the coconut-oil business has taken a jump. From 1905 to 1910 the vegetable-oil business of the city of Marseille doubled in value and by 1915 it is probable that the oil and oil-cake industry there will amount to over ₱200,000,000 per annum. The local purchases of copra during the past five years in Marseille have increased by 70 per cent, this increase being due very largely to the remarkable development of the coconut-oil industry of which Marseille is the most important center, though several cities in Germany and England

are now following suit. When we remember that the Philippines are now supplying fully one-third of the copra of the world, we can readily see that the copra business of these Islands is a matter of very many million pesos each year to the aforesaid city of oils.

PAPAYA GUM.

The current wholesale price for ordinary dried papaya gum is now about ₱25 per kilo. At this price there appears to be a good opening for the Philippine planter who happens to have plenty of papayas on hand to increase his income with an outlay of only a few pesos for porcelain trays. Papayin is rapidly replacing animal pepsin in the drug market of the world; it is said that one of the strong points is that its continued use does not result in the so-called "second-nature" feature, whereby the patient would be obliged to gradually increase the dose.

ELEPHANTS AS WORK ANIMALS.

Only a few decades ago there were elephants in the Philippine Islands; in fact, they did so well in a wild or semiwild state in the Island of Jolo that the natives in self-defense, to save their crops, were compelled to exterminate the herd. Since then the idea of introducing elephants for draft purposes has been broached several times and it is still a debatable question whether the fact that the elephants of India are now thought to be occasionally affected with surra, or some disease very much like it, should entirely preclude the possibility of introducing them here as rivals of the carabao.

At last, after several years of failure, and probably for the first time since Hannibal used them in his campaigns in southern Europe some twenty-three centuries ago, the African elephant has finally been put to work. At the new Station de Domestication des Elephants at Api, in the Belgian Congo, there are some 35 or more fine young elephants, most of which are trained to the plow, the wagon, and the pack. However, these elephants are still young, probably from 6 to 12 years old, having been captured in the adjacent forest during the past two or three years. They promise to excel all other domestic animals for ordinary work on tropical estates. They are easily kept, have few diseases, are remarkably intelligent, and probably the strongest of all the domestic animals, even in proportion to their size; to comprehend their strength one has only to compare the pillar-like, full-muscled leg with the slender bony limb of a horse, ox, or carabao; one elephant of even only 1.6 meters in height has about as much "pulling power" as 4 carabaos.

In Mindanao, and probably in many districts of Samar, Mindoro, Palawan, and similar provinces, the elephant could be easily kept and would prove exceedingly valuable in the development of plantations, especially in forest regions. A most important question is, of course, that of the immunity of these animals to the diseases which for at least two score years have played such a tremendous part in retarding the agricultural development of this Archipelago.

ERRATUM.

The legend accompanying Plate III in the REVIEW for December, 1911, reads: "Mexican Fruit Fly (*Trypeta ludens* Loew). (1) male adult; (2) female; (3) pupa; (4) larva."

A statement should have been added to this legend to the effect that the illustration was much enlarged, as the real length of the fly is only about 5 millimeters.

MONTHLY VETERINARY REPORTS—DECEMBER AND JANUARY.

By F. W. Wood,
Acting Assistant Chief Veterinarian.

Albay and Ambos Camarines.—No rinderpest has been reported to date.

Bataan.—The situation is practically the same as at last report due to lack of men to handle the disease. Four municipalities are infected with rinderpest.

Batangas.—The municipality of Lobo has been freed from rinderpest but the disease is still present in San Juan de Bocboc.

Bohol.—Reported clean this month.

Bulacan and Pampanga.—The situation remains unchanged.

Cagayan and Isabela.—Five municipalities are known to be infected. Permanent improvement in these provinces can not be expected until sufficient men are available for assignment to this district.

Cebu.—Six municipalities have been declared free from rinderpest since last report. This leaves but one known infected municipality in this province.

Cavite and Rizal.—No rinderpest has been reported from these provinces.

La Laguna.—Two municipalities are infected—Cavinti and Lumbang.

La Union.—Four municipalities are infected in this province.

Leyte.—No rinderpest is known to exist in Leyte at this time.

Nueva Ecija.—Two municipalities are infected in the southern district of this province.

Oriental Negros.—Declared free on January 8, 1912.

Pangasinan.—Infection still exists in one municipality—Bayambang.

Tarlac.—Gerona is the only known infected municipality in Tarlac.

Tayabas.—The municipality of Infanta is infected.

Zambales.—No cases of rinderpest have been reported from this province for over two months.

General conditions.—The rinderpest situation as a whole shows satisfactory improvement. There are at this time 29 known infected municipalities in the Islands. The outlook is especially bright in the southern islands, where only one municipality is known to be infected.

MONTHLY CROP CONDITIONS—DECEMBER.

CORN.

Bohol.—The corn has been mostly harvested throughout the province.

Cebu.—The general condition of the plantings is excellent and a considerable harvest is expected.

Ilocos Norte.—There was a little rain during the month and the people have been very busy planting corn and vegetables.

Ilocos Sur.—Owing to the lack of rain, some of the standing corn is looking fine, while the rest is poor.

Isabela.—The last year's crop is practically all consumed and the residents, especially those residing in the northern part of the province, are completely out of corn. The new crop is growing fine and unless destroyed by baguio or drought the harvest will be nearly twice as large as that of last year.

Leyte.—The corn yield in all localities is abundant. Hunger does not seem to be severely felt in the province as it has been during the past few months, the large corn crop being in large measure responsible for the change.

Oriental Negros.—Corn promises to do well. The price has dropped to ₱4 per cavan.

RICE.

Ilocos Norte.—There has been a loss of about 42 per cent of the rice crop in this province owing to the extreme drought. There are no reasons to fear a famine in this province. The local price of rice per cavan is now ₱7.

Iloilo.—For more than two months there has been practically no rain and as a result 75 per cent of the late rice plantings, that upon which the natives are most dependent, has been a failure. Rice reached an unusually high price, and notwithstanding this it is being purchased and stored by speculators.

La Union.—The people of this province are beginning to awaken to the rice shortage, and are planting camotes in considerable quantities.

Occidental Negros.—Palay is being harvested; it is not up to standard; shortage is reported in several of the palay districts.

Nueva Ecija.—The palay crop will yield only about 10 to 15 per cent as much as usual owing to lack of rains.

Pampanga.—The rice crop is very short. It is estimated that

throughout the province there has been a loss of 60 per cent of the usual crop.

Pangasinan.—It is estimated that the loss in production is 80 per cent in the most affected towns and 50 to 70 per cent in the less affected; this is on account of drought.

Tarlac.—The light rains that fell toward the close of November did the palay crop no good and the situation outside of the towns of Tarlac, Camiling, Concepción, and Bamban is gloomy indeed. The palay crop in the other towns was extremely short and, owing to the continual dry weather, the people are unable to plant corn, camotes, and vegetables.

Tayabas.—Rice is getting scarce on account of the continuous drought and although no famine is feared in this province a good deal of trouble is expected.

SUGAR CANE.

Batangas.—Dry weather is hurting sugar, and milling is already beginning.

Cebu.—The plantings of sugar cane seem very excellent throughout the province, and milling has been already begun.

Cotabato.—There have been large areas of lands cleared in the vicinity of Bagumbayan for the planting of sugar cane. The land in the vicinity of Simuay River produces a very good grade of sugar cane and four or five mills are in operation in that section.

Iloilo.—New plantings of sugar are dying and many who desire to plant can not do so on account of the hardness of the ground. The grade of sugar being milled this year is far superior to that of any previous year, though the yield is greatly diminished owing to the excessive rain during the early part of 1911. The price is good and will probably get better as contracts for May deliveries have been made at ₱9 per picul.

Occidental Negros.—The sugar crop is being harvested and is reported as fair. Many small fires are reported in the cane fields.

Oriental Negros.—The condition of the sugar cane is very poor. Hacenderos have begun to mill sugar and the crop in the north promises to be above the average.

Pampanga.—This province has the advantage of many of the other provinces, due to the fact that a great deal of sugar is raised; in fact, the principal crop is sugar, whereas other provinces depend almost entirely on the rice crop.

Tarlac.—The condition of the sugar cane is only fair, owing to the drought which is still prevailing throughout the province.

MARKET REPORTS.

NOTES ON MANILA MARKETS FOR JANUARY.

By KER & Co.

[Based on advices from New York, November 17; San Francisco, November 29; London, November 30; Iloilo, December 26; Hongkong, December 28; Cebu, December 30.]

SUGAR.

Iloilo.—Market quiet, little doing. Arrivals are still trifling. Small lots are being taken on the basis of ₱7.50 per picul[1] first cost for No. 1.

Manila.—Market quiet. Arrivals also are of little account. We quote ₱6.75 per picul first cost for No. 1 polarization 88°.

HEMP.

During the fortnight market has been firm for both better and lower grades, but there has been little free hemp arriving. We quote ₱16 per picul for good current f. o. b., ₱10 per picul for United States, and ₱9 per picul for United Kingdom current f. o. b.

COPRA.

Market for Cebu fair merchantable sun-dried has been firm with buyers but no sellers of any quantity at ₱11.50 per picul f. o. b. Manila fair merchantable is steady at ₱10.50 to ₱10.75 per picul.

DISTRIBUTION OF PRINCIPAL PHILIPPINE EXPORTS FOR THE TWELVE MONTHS.

[January to December, 1911.]

Products exported.	United States.	China.	Pacific coast.	Great Britain.	Continent of Europe.	Australia.	Japan.	Singapore.
Dry sugar (tons)	168,462	15,723	16,700	4,697				
Hemp (bales)	467,942	11,053	51,331	469,580	98,669	25,707	24,592	11,136
Copra (piculs)	59,360	10	175,280	72,000	1,895,536		4,463	
Cigars (thousands)	21,312	38,058	20,286	12,567	13,783	11,563	1,072	15,701

[1] One picul equals 63.25 kilos.

MANILA AND LONDON FIBER MARKET.

RECEIPTS AND SHIPMENTS OF MANILA HEMP.

[Telegram from Manila to London, January 22, 1912.]

	1912	1911
	Bales.	*Bales.*
Hemp receipts at:		
Manila since January 1	67,109	56,475
Cebu, etc., since January 1	13,402	23,078
All ports since January 1	80,511	79,553
Shipments by steamer to:		
United Kingdom, cleared since January 1	57,635	30,925
Atlantic coast, United States, cleared since January 1	20,918	40,107
Pacific coast, United States, cleared since January 1	16,011	7,535
Continental ports cleared since January 1	8,855	6,281
Shipments to all other ports and local consumption since January 1	2,043	2,144
Loading steamer on the berth for Atlantic coast, United States, about	7,000	15,000

Bales of hemp loading for United States by steamer "Suruga" (Cebu) 7,000

LONDON FIBER MARKET.

The following prices for Manila hemp, sisal, and maguey were quoted by Messrs. Landauer & Co., London, and Messrs. Sloan & Mitchell, of Manila, on December 20, 1911:

Manila hemp.—Receipts for the week are cabled as 29,000 bales against 27,000 bales for the corresponding week last year. For the next two weeks receipts are estimated at 48,000 bales. Fine hemp has been idle. The shipping houses offer very sparingly, but, on the other hand, buyers exhibit no anxiety to contract ahead. Hemp on spot has ruled steadier, in sympathy with the better market for forward shipment. Business done includes fair current on spot at £20 to £20 5/-, and good brown at £19, old contract terms.

Range of prices.

Grades.	Spot and close by.			Manila, per picul.
	Per ton.	Per ton.	Per picul.	
Best marks	40/-–43/-	₱400.00–₱430.00	₱25.00–₱26.90	
Good marks	38/-–40/-	380.00– 400.00	23.75– 25.00	
Good current	34/-–34/6	340.00– 343.00	21.25– 21.43	₱15.60
25 per cent over current	22/-–22/6	220.00– 223.00	13.75– 13.95	10.40
Fair current	20/-–20/3	200.00– 201.50	12.50– 12.59	
Superior seconds	19/6–19/9	193.00– 194.50	12.10– 12.16	8.00
Good seconds	19/3–19/6	191.50– 193.00	11.97– 12.10	7.50
Fair seconds	19/-–19/3	190.00– 191.50	11.85– 11.97	
Good brown	18/9–19/-	184.50– 180.00	11.55– 11.85	
Fair brown	18/9–19/-	184.50– 180.00	11.55– 11.85	

Sisal hemp.—Extreme firmness has dominated this market. Quotations have ruled very irregular. In New York the price is reported to be 4⅞ cents, equal to £23 10/- to £23 15/-, charges including freight Europe. On the other hand, cable information

from Progreso reports that the parties who hold the present somewhat heavy stocks have secured financial support from the bankers, and rumor has it that a valorization scheme is to be arranged for the purpose of fixing prices, but up to the time of going to press no official confirmation of any such scheme having been actually concluded has come to hand. Meantime, the price in Progreso and in the interior of Mexico has sharply advanced, the quotation from those quarters being equal to £25 10/-, charges including freight Europe.

Manila maguey.—A good demand exists. Quotations are £19 to £19 5/- No. 1 Cebu, £16 15/- ordinary No. 1, £15 10/- No. 2, and £14 No. 3. The Manila quotations for the same date were ₱6.60 per picul for No. 1.

NOTE.—The above quotations are in pounds and shillings English currency per ton. One pound equals 10 pesos Philippine currency. One ton equals approximately 6 piculs.

ILOILO SUGAR MARKET.

The arrivals of sugar in Iloilo from the mills and sugar districts were 31,865 piculs in October, 25,805 piculs in November, and 143,395 piculs in December.

During October there was a gradual fall in price from 8 pesos and 3½ reales [1] at the beginning of the month to 7 pesos and 7½ reales, which quotations were only nominal, having no buyers. In November, however, the market opened with 8 pesos and 2 reales, but this went down on the 14th to 7 pesos and 4 reales, the same having prevailed up to the close of December.

The following summary of the Iloilo sugar market indicates the range in price for the 1910–11 sugar crop. During the months from November to March there was a marked increase in price from 5 pesos and 6 reales to 6 pesos and 6½ reales; in April and May the price dropped slightly, but went up very rapidly during June, July, and August to 8 pesos and 4½ reales, and in September and October this price dropped to 7 pesos and 7½ reales.

October shipments.

[In piculs.]

Date.	Vessel.	Destination.	Superior.	Wet.
Oct. 7	Tean	Hongkong		1,197
Oct. 10	Panay	Manila	3,899	
Oct. 18	Taming	Hongkong		1,519.33
	Total for October		3,899	2,716.33

[1] One real equals 12½ centavos.

November shipments.

[In piculs.]

Date.	Vessel.	Destination.	Superior.	Wet.
Nov. 7	Hercules	San Francisco	57,600	
Nov. 21	Panay	Manila	3,200	
Nov. 21	Elcano	do	4,800	
Nov. 24	Walton Hall	United States	24,000	
	Total for November		89,600	

Exports up to December 31, 1911.

[In piculs.]

To—	1910-11 crop.		1911-12 crop.	
	Superior.	Wet.	Superior.	Wet.
United States	33,600		89,600	
China	52,596			
Total	86,196		89,600	

Estimated sugar crop, 1911-12, for Panay and Negros.

	Piculs.
Panay:	
Balasan	7,000
Barotac Nuevo, Dumangas, Zarraga, Dingle, Passi, and Pototan	95,000
Concepción, Ajuy, and Sara	42,000
Province of Capiz	14,000
Province of Antique	76,000
Total	234,000
Negros:	
Victorias	59,000
Valladolid	16,000
Manapla and Sicaba	128,000
Bayauan	3,000
Hinigaran	31,000
Himamaylan and Suay	68,000
Tanhay, Amblan, and Ayuquitan	15,000
San Carlos and Vallehermoso	156,000
Bais	65,000
Cabancalan and Ilog	118,000
Binalbagan	21,000
La Carlota, Pontevedra, San Enrique, and Candaguit	158,000
Isabela	134,000
La Castellana	52,000
Bago	133,000
Bacolod, Granada, Murcia, and Sumag	81,000
Talisay	90,000
Silay and Eustaquio Lopez	188,000
Sarabia	84,000
Dumaguete, Nueva Valencia, Bacong, and Sibuyan	12,000
Cadiz Nuevo and Sagay	154,000
Total	2,000,000

NOTE.—The 1910-11 crop is estimated at 2,180,000 piculs so that there is a shortage of 180,000 piculs in the present crop.

ESTIMATED ILOILO SUGAR CROP, 1910-11.

Stocks, October 31, 1911.

	Piculs.
No. 1 sugar	11,563
No. 2 sugar	13,039
No. 3 sugar	65,988
Wet	10,310
Current	8,700
Total	109,620
Exports to date as per our Circular No. 51	2,194,343
	2,303,963
Less stock on October 30, 1910	125,634
Total crop, 1910-11	2,178,329
Our estimated crop for 1910-11 on October 30, 1910	2,096,000
Our estimated crop, 1911-12	2,000,000

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—DECEMBER.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Total.
Rice	Kilos	3,522,962	600,536	1,956,761	6,080,259
	Value	138,846	23,926	75,614	238,386
Beef cattle	Number	704	2		706
	Value	24,070	48		24,118
Eggs	Dozens	362,989	118	410	363,517
	Value	29,297	7	16	29,320
Sugar	Kilos	133,080	3,744	42,368	179,192
	Value	11,510	310	3,204	15,024
Coffee	Kilos	65,241	129	1,148	66,518
	Value	21,905	41	426	22,372
Cacao	Kilos	78,050	10,221	616	88,887
	Value	25,202	3,260	243	28,705
Raw cotton	Kilos	23,965			23,965
	Value	6,429			6,429

EXPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Total.
Hemp	Kilos	12,159,085	652,740		12,811,825
	Value	1,270,952	65,598		1,336,550
Copra	Kilos	14,273,144	2,322,899		16,596,043
	Value	1,461,003	271,607		1,732,610
Sugar	Kilos	1,615,702			1,615,702
	Value	133,774			133,774
Cigars	Number	16,024,633			16,024,633
	Value	234,307			234,307
Cigarettes	Number	2,999,140			2,999,140
	Value	2,325			2,325
Tobacco	Kilos	1,097,286			1,097,286
	Value	175,047			175,047

PLATE I. AGRICULTURAL-HORTICULTURAL BUILDING, FIRST PHILIPPINE EXPOSITION, 1912.

EXPOSITION NUMBER

THE PHILIPPINE

Agricultural Review

VOL. V   APRIL, 1912   No. 4

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

PHILIPPINE EXPOSITIONS.

The First Philippine Exposition was opened to the public at 4 o'clock on the afternoon of February 3, 1912. It continued for a period of ten days, closing on the evening of February 12.

Considered as a whole, the Exposition was an unqualified success. The provincial and Insular exhibits, which have been formerly a part of the Carnival, were far superior to those of previous years. The new features, of which the more prominent were the machinery and commercial exhibits, were highly satisfactory and contributed in no small measure to the educational value of the Exposition. The arrangement of the grounds, the construction of the buildings, the installation of exhibits, and the supervision of the minor details of the Exposition were of a degree of excellence highly creditable to those who were intrusted with its management.

The reasons why our expositions and carnivals are held, and the direct and indirect results that are obtained, are too generally and well understood to require further discussion. It is sufficient to state that the recent Exposition demonstrated beyond question its value as an educational factor in the life of the Filipino people, that it served to promote harmony and coöperative effort, and that it was a decided stimulus to business and the various industries of the Islands.

It may be desirable, however, while the details of the Exposition of 1912 are fresh in our minds, to consider briefly certain features of this Exposition with reference to development and improvement at the next Exposition that shall be held in Manila.

It becomes more and more apparent every year that the Philippine Islands contain a wealth of material suitable for the preparation of interesting and attractive exhibits. It is evident, furthermore, that not only the inclination, but also the ability, exists among the people of these Islands to prepare exhibits worthy of much wider attention on the part of other countries than they now receive. Having demonstrated these facts, it remains only to still further improve the high standard of our exhibits already established, and then to demonstrate to the outside world the attractiveness of our Philippine expositions in such a forceful and convincing manner that our foreign visitors shall be numbered by hundreds instead of dozens.

It has been suggested, and the suggestion is worthy of consideration, that arrangements be perfected for holding in Manila every second year a midwinter exposition, that this exposition

be known and widely advertised as the *Philippine Midwinter Exposition*, and that it be open for a period of not less than two weeks. It would seem desirable that our expositions be made a permanent institution, to be held at regular and stated intervals, and there is strong argument in favor of the biennial rather than the annual exposition. The use of the designation "Philippine Midwinter Exposition" would be attractive for advertising purposes, and would tend to bring about a better understanding in other countries as to the time of year when our expositions are held. The opinion was frequently expressed that it was unfortunate that it was impracticable to continue the recent Exposition for a longer period, and it is probable that our future expositions should remain open for at least two weeks. The importance of widely and effectively advertising our expositions is too self-evident to require comment.

Among the more important means of improvement for the next Exposition, that have been brought to our attention, is the matter of separating the exhibit and sales features. Two classes of people visit an exposition, those who desire only to view the exhibits, and those who desire to make purchases. The combination in a limited space of the exhibit and sales features is most unsatisfactory. Where a part of an exhibit is on sale, the entire exhibit soon becomes disarranged and unsightly, and likewise the prospective buyer finds that an exhibit room is not a satisfactory place in which to make purchases. In nearly all of the exhibits at the 1912 Exposition a part of the material on exhibit was offered for sale. Although the greater part of such material was not removed until after the close of the Exposition, the inevitable result was that many of the exhibits soon became disordered and unattractive. The presence of both purchasers and sightseers in one building tends, also, to larger crowds than can be easily handled. It should be possible to effect an arrangement whereby all material for sale could be placed in one "sales building" under the supervision of competent salesmen. This arrangement would undoubtedly largely increase the amount of sales, and would also greatly improve conditions in the exhibit buildings.

It has been suggested that at the next Exposition one building be devoted to "household industries." Many of the visitors at our expositions are particularly interested in these industries, which include the weaving of various textile fabrics, carving, the making of hats, mats, footwear, coconut-shell products, and numerous other articles. Where this work is widely scattered throughout a large number of exhibits there is a great amount of

expensive and unnecessary duplication, and its inspection becomes a long and tiresome task that could be largely overcome by grouping all of these industries in one building.

Other matters that have been mentioned in connection with future expositions are the encouragement of more foreign exhibits, the appointment of some one person in an advisory capacity to assist in the installation of provincial exhibits, and the continued effort to avoid duplication in the different exhibits and to further develop the idea of centralization of the more important features.

The Exposition of 1912 was so far in advance of all previous efforts that it may well be considered as above criticism. This does not mean, however, that there is not still room for improvement, and we fully believe that our next Exposition will be such as to entirely remove any lingering doubts that may still exist as to the advisability of making the biennial Philippine Midwinter Exposition a permanent institution.

INSULAR BUREAU EXHIBITS AT THE FIRST PHILIPPINE EXPOSITION.

THE EXHIBIT OF THE BUREAU OF NAVIGATION.

By LAURITZ LAURITZEN,

Assistant Engineer, Bureau of Navigation.

In a country where the bulk of traffic is waterborne, as is the case with the Philippines, the construction and maintenance of adequate port works and an efficient lighthouse service is of paramount importance.

These two spheres of governmental activity are under the control of the Bureau of Navigation, and the divisions which they form have their headquarters and shops at Engineer Island, near the mouth of the Pasig River.

The Bureau of Navigation exhibit was located at the north end of Machinery Hall. At the entrance of the building were placed two 50-foot (15.24 meters) steel towers, types of structures which are replacing the wooden towers, formerly built, as rapidly as practicable. The old wooden towers have in the past required frequent attention from repair parties, and the new steel towers reduce the maintenance cost considerably. During the past year four such towers have been erected, and the three on view at the Exposition will be sent out shortly to their designated sites.

In the main exhibit the background was filled by a large map of the Philippines, on which all existing lights were shown by small incandescent bulbs. They number 143 at present.

On the right the lighthouse division had set up a flashing apparatus of the first order. There are four lights of this size now in commission. Two are located on the north coast of Luzon at Capes Engaño and Bojeador, one is at Cabra near the entrance to Manila Bay, and the fourth at Cape Melville near the south end of Palawan.

Lights are designated by orders, according to their size and power, thus, first, second, third, fourth, fifth, and sixth. Still smaller than the sixth order is a class known as lens lanterns.

Alan Stevenson, the great Scotch lighthouse engineer, said:

> Nothing can be more beautiful than an entire apparatus for a fixed light of the first order. It consists of a central belt of refractors, forming

a hollow cylinder 6 feet (1.83 meters) in diameter and 30 inches (0.76 meter) high; below it are six triangular rings of glass, ranged in a cylindrical form, and above a crown of thirteen rings of glass, forming by their union a hollow cage, composed of polished glass, 10 feet (3.05 meters) high and 6 feet (1.83 meters) in diameter. I know of no work of art more beautiful or creditable to the boldness, ardor, intelligence, and zeal of the artist.

A first-order apparatus is 12 feet (3.65 meters) high and 6 feet (1.83 meters) in diameter; a second order, 4 feet 7 inches (1.39 meters) in diameter; third order, 3 feet $3\frac{3}{8}$ inches (about 1 meter); fourth order, $19\frac{5}{8}$ inches (0.49 meter); fifth order, $14\frac{1}{3}$ inches (0.36 meter); sixth order, $11\frac{3}{4}$ inches (0.30 meter).

The distance a light can be seen is limited only by the horizon. The elevations above high water, order, and visibility of the highest Philippine lights are as follows:

Lights.	Elevation.		Order.	Visibility.	
	Feet.	Meters.		Miles.	Kilometers.
Corregidor	630	192.02	Second	33	53.11
Ambolon	446	135.54	Sixth	15	24.14
Suluan	438	133.50	Fourth	28	45.62
Apo Island	428	130.45	Sixth	16	25.75
Bojeador	386	117.65	First	26	41.84
Sialat Point	355	108.20	Sixth	15	21.14
Caballo	319	97.23	do	15	21.14
Cape Engaño	315	96.01	First	25	40.23
Batag	313	95.40	Third	25	40.23
Ungay Point	305	92.96	Sixth	15	21.14
Bolinao	301	91.74	Third	24	38.62
Cape Melville	296	90.22	First	24	38.62

The first-order apparatus on view was bought complete in France by the Spanish Government and placed by it in the tower at Capones Islands. It was afterwards removed by the Americans as of larger size than needed at that point, and a third order substituted. It is proposed to install the light in a new station to be built at Sibago Island, off Zamboanga.

On the left was shown the apparatus of a fourth-order flashing light of the newest type. The lenses are carried by a platform partially immersed in mercury. This type combines the greatest stability and durability with the minimum of power required to revolve the lighting apparatus.

These two lights are examples of flashing lights. The flash is produced by revolving the glass lenses around a stationary burner. Smaller lights are frequently occulting and several examples of this type were on view. In general, a flashing light is one in which the flash is of a second's duration or less, while an occulting light is a fixed light which at regular stated intervals suffers a total eclipse.

In an occulting apparatus, the burner and lens are both stationary and the dark periods are produced by the revolution of a metal screen between them. All occulting lights in the Philippines are of the sixth order.

There are few fixed white lights in the Philippines, since a fixed light is easily confused with a fire on shore, or the light in a fishing boat or elsewhere. Consequently it is necessary to arrange a light by means of varying lengths of dark periods, the number of flashes per minute, or otherwise, so that it may be distinguished from other lights. The characteristics of lights are carefully described in books for distribution to mariners in order that a vessel in "picking up" a light may at once know by its characteristics where the light is located.

A complete assortment of lenses, burners, chimneys, and other accessories completed this section of the exhibit.

The division of port works and lighthouse construction exhibited the large map referred to in a previous paragraph and a collection of models of work executed.

On the left was shown, first, a model of pier 5, Manila, a dock which would be a credit to any harbor in the world, and one to which ships the size of the *Manchuria* or *Cleveland* can tie up, an improvement of incalculable benefit to the business community.

Next was a model of the approach shed to pier 5. This was built in 1910 and houses various offices of the customs service. This model is on the same scale—one-twenty-fourth—as that of the dock itself.

The south and west breakwaters of Manila Harbor were represented by cross sections. Of these, the south breakwater was built entirely under American occupation. The west breakwater was completed by the division of port works, but actual work was begun by the Spanish Government in 1880, the papers in the matter having circulated between the various departments since 1833, a trifling delay of forty-seven years.

Models were also shown of the concrete harbor walls at Iloilo and Cebu, both works which have been of immense benefit to these busy shipping points.

The division of port works also has charge of the construction and repairing of lighthouse buildings, and showed three models of typical structures.

The first was a model of the Lauis Ledge light near Cebu. This station is located on a coral reef in the southern entrance of the narrow sound between Cebu and Mactan. The house is built throughout of reinforced concrete supported by concrete pillars. The roof is of concrete and is surmounted by a very graceful tower built of steel tubing, carrying the light.

The second model was that of a standard sixth-order station with occulting light. This is also a reinforced concrete building of attractive appearance. The model shows a cupola surmounting the building and carrying the light. Where local conditions require a greater elevation of the light, this cupola is omitted and the light is placed on a steel tower of the type shown at the entrance to the building. During the past year six stations of this type have been built to replace old, unsafe nipa or wooden structures. Two smaller stations of the same general appearance and construction have also been built.

Finally there was a model of a standard 20-foot (6.09 meters) reinforced-concrete beacon. This is a type of structure which has been very successful for small lights marking the entrance to ports. The simplicity of the structure, which consists throughout of reinforced concrete, makes it practically everlasting and the cost of maintenance is practically nothing. During the past year, eleven of these have been built and seven more are planned for early construction.

THE EXHIBIT OF THE BUREAU OF PUBLIC WORKS.

This exhibit, in charge of Mr. G. G. Ball, was one of the most popular in the Exposition. The attendance totaled about 200,000 persons, and on Sunday the 11th, in the afternoon, there were nearly 10,000 visitors within two hours.

The main purpose of the exhibition was to show results. Models, charts, black-and-white drawings, electric signs, and large colored and framed photographs were all used to this end.

The allotted space, while central, was small in area. It was all utilized. The interest displayed was unprecedented in the history of public works in the Philippines. Whether the visitors were Government officials, tourists, residents of Manila, or from the provinces, nearly everyone made the entire round of the several wings. Perhaps the most intense interest was displayed by people from the country. At almost any hour groups of these could be seen explaining different features to one another or comparing results in their own provinces with those elsewhere.

The Bureau began work some nine years ago as the Bureau of Engineering. The first two years were devoted to general investigations of conditions. Then the artesian-well, the bridge, the road, and the building policies were successively clearly defined and real work commenced. The Bureau was therefore at this Exposition able to show results for those four major lines of activity. The responsibilities of the Bureau have increased literally by leaps and bounds. To-day—with the munici-

palities coming more and more to appreciate the desirability of trained advice and supervision for public improvements—it carries the responsibility for nearly all public works in the thirty-one Christian provinces and Baguio, other than port works and railroads. This comprises an area of two-thirds of the total area of the Islands, containing some nine-tenths of the total population.

The Bureau is therefore the general engineering Bureau of the Philippine Government. The work done is more varied than usually falls to the lot of similar government engineering organizations.

The classes of work include not only roads, bridges, buildings, artesian wells, and irrigation, but also such items as the operation of electric-light plants and automobile lines, plans for hydro-electric installation, water supply, sewage disposal, gas plants, and ice plants. The Bureau now contains in the neighborhood of 100 distinct organization units. It has been difficult to secure and retain a personnel, sufficiently well trained to care for these classes of work varying greatly in character, and at the same time to exhibit results to the particular government—whether municipal, provincial, or Insular—which furnished the funds. The exhibit demonstrated that the Bureau has succeeded both in following very definite lines of policy for the different classes of work and in obtaining substantial results therefrom.

The most marked showing was in road construction. Beginning in 1908 with only 487 kilometers of indifferent heavily surfaced road of many different designs, this length was not only increased 226 per cent in four years, but both the old and new work were brought to a uniform standard. On June 30, 1911, there were 1,588 kilometers of very fair heavily surfaced road, all to a single standard, well drained, and of fair line and grade. This fact in the exhibit was brought out by a large colored chart as were also the related figures on present population and length of coast line. The large colored photographs showed the new or reconstructed roads in a number of provinces. The most striking road exhibit was one illustrating progress during the year. This was a large black-and-white transparency stating that the record for road building in the Philippines was the 357 kilometers built in 1911. A series of electric bulbs in a space 1 meter long was lit up at the rate of one every twenty-nine seconds, the space illumined by each bulb representing 1 meter of road. This illustrated the rate at which road construction had advanced during each working hour of the entire year. Other exhibits gave the average cost of completed heavily

surfaced roads with durable structures as ₱10,200 per kilometer, the average value of traffic, excluding produce consumed locally and produce and shipments rehandled, was ₱139 per kilometer. Still another indicated that an additional 3,000 kilometers of surfaced road were needed in the near future.

These other colored charts showed the expenditure of nearly ₱1,000,000 in the thirty-one provinces simply for up-keep of roads during the year. One of these exhibited the most remarkable public-works development in the recorded history of the Islands, viz: The persistent growth of the isolated "caminero" system of maintenance. This is the system employed on all heavily surfaced roads and consists in stationing one man either every kilometer, or every 2 kilometers, depending upon the season, and making him personally responsible for that short section. Beginning in 1908 with only about 300 kilometers this system grew each month until December, 1911, the length so maintained was nearly five times the original length. When we appreciate the fact that the provinces, unaided by the Insular Government, finance the road maintenance, it is very evident that the Bureau showed results for this feature.

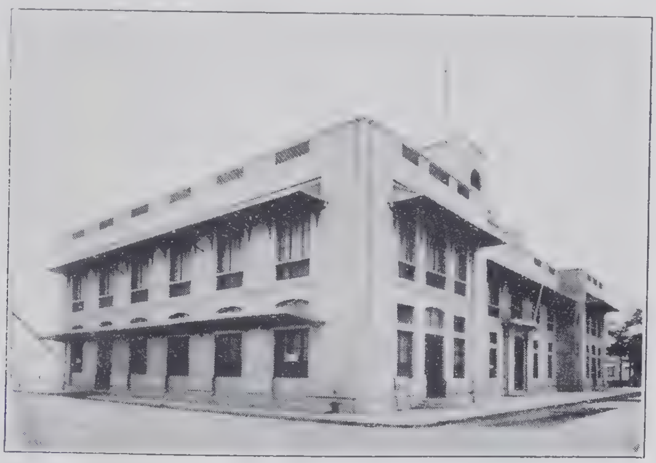
This system of organized caminero maintenance is under the supervision of the district engineers of the Bureau. The system of inspection whereby the maintenance is kept effective consists: First, of a daily tour by the "capataz" over the work of the camineros on the several kilometers in his charge; second, of a weekly trip by the foreman over the sections under the several capataces; third, a bimonthly inspection by the district engineers; and, fourth, a quarterly inspection by the division engineers. As a result the roads, once completed, show a constant improvement thereafter. The parts of the road system which are not maintained by the isolated caminero system are kept up by gangs.

In 1906 the sound and progressive general policy, for public structures as durable as possible and well maintained, was brought to bear on bridges and culverts. This involved the extensive use of reinforced concrete, of new standards and new designs. The reinforced road structures found in nearly all the provinces to-day are in accord with the best modern engineering practice.

The number of bridges and culverts in the Philippines has doubled during the past four years, and the total length of span has increased 360 per cent. Some 1,332 reinforced-concrete structures have been built. A number of enterprising municipalities have built bridges of one or more arches over waterways

UPPER FACE (SIDE VIEW), STORAGE DAM, OSMEÑA WATERWORKS, CEBU, CEBU.

JULIAN DAM, IMUS ESTATE, 2 KILOMETERS SOUTH FROM IMUS, CAVITE DIVISION.



CUSTOM-HOUSE, CEBU, CEBU.

VAUGHAN BRIDGE, ON SAN PEDRO TUNASAN-CALAMBA ROAD, KILOMETER 25, LOOKING NORTHEAST, LA LAGUNA.

PLATE II.

PLATE III.—BAY-SAN PABLO ROAD, LOOKING WEST—KILOMETER 52, LAGUNA.

of considerable width. The exhibit showed this noteworthy improvement by means of charts, models, and photographs.

In the section devoted to building work appeared wash drawings of the new capitol of the Philippine Islands at Manila by Mr. G. C. Fenhagen, assistant architect, designed under the supervision of Mr. W. E. Parsons, Consulting Architect to the Commission. This was the largest item of proposed work exhibited. The drawings showed exactly how it is expected to utilize Wallace Field in connection with the Luneta improvements. The design for the capitol is noteworthy in that it has assumed nearly final shape without enlisting help outside of the Islands.

The remainder of the building exhibit showed the effect of the general building policy of the Government which is, briefly, to confine new construction to concrete, stone, or a superior grade of native hardwood properly seasoned. A chart in the exhibit showed 158 buildings constructed during the year and a total cash expenditure for all building work of nearly ₱2,600,000. There were large colored photographs of new hospitals, new provincial buildings, schools, and similar public works largely of reinforced concrete throughout. Nearly one-third of the buildings constructed during the year were public schools of one class or another. The Consulting Architect, by means of a force on the Bureau pay roll, prepares all building plans and estimates.

The artesian-well exhibit showed very definitely the large results obtained in the past seven years. Over 500 wells have been driven and these all produced potable water. Two well-rig models were shown. One was that of a deep-well rig with a capacity of 914.40 meters in any kind of ground. The other rig model was of the kind which sinks pipe in soft soil by means of a jet of water. About four-fifths of the total number of wells driven have been successful. They have all been driven in the most thickly populated territory of the provinces. The exhibit also included a model showing strata in their relation to artesian wells.

It is computed that within carrying distance of the 500-odd successful wells there are 1,000,000 people. Large colored photographs showed two of the flowing wells recently completed.

A large relief map showing by actual running water the proposed plan for irrigating the 30,000 hectares between Malolos and Norzagaray in Bulacan Province, was, from the point of view of the visitors, one of the most attractive of the exhibits. The estimate of the cost of this irrigation plant was ₱2,500,000.

For this sum, and without any particular increase in the number of farmers, the production can be greatly increased.

A plan and chart showed the present situation as regards the territory from Bulacan north of Pangasinan. Exclusive of occasional brush-and-stone dam work put in by the farmers themselves, there are now only three small tracts of irrigated land in this territory, totaling 750 hectares in area. There are ten other tracts, with a total area of 250,000 hectares, which are adapted to irrigation by modern and systematic methods. The present rice production of this part of the central valley of Luzon is only four and one-half million cavans [1] of rice yearly, valued about ₱30,000,000. Irrigation would double the production and value of the products and insure against drought.

The area now irrigated in the thirty-one Christian provinces by modern methods is about 50,000 hectares as against 450,000 hectares irrigable.

Other parts of the exhibit showed the Osmeña dam and reservoir recently completed to supply water for the city of Cebu, operation of the Benguet automobile line, and some old Spanish irrigating works and bridges. The colored photographs of the Benguet country were interesting as showing the passage of automobile freight and passenger trains over the road in the latter part of January, 1912.

THE EXHIBIT OF THE BUREAU OF HEALTH.

By Dr. G. I. CULLEN, *District Health Officer.*

The Bureau of Health was represented by a sanitary exhibit located in the center of the Insular Building of the Exposition covering an area 10 meters long and 7 meters wide, and an emergency hospital consisting of two large hospital tents located in the Carnival Grounds near gate No. 2.

In the exhibit were displayed a modern bathroom, models of sanitary houses, a municipal water filter, artesian wells, and a sanitary privy; also two relief maps in modeling clay of the barrio of Santa Monica showing its condition before and after reconstruction by the Bureau; a small ice machine; an incubator; rat traps; sanitary bottles and carriers for milk, tuba, etc.; the various kinds of rice; case containing stuffed rats; jars containing flies and mosquitoes, and a small disinfecting pump. In addition, demonstrations of infant feeding were given by a trained nurse.

On the walls were displayed charts showing the birth and

[1] One cavan equals 75 liters.

death rate of Manila by years for the past ten years, cycles of the fly and mosquito development, and the diseases transmitted by them, the rat flea, rat guards for vessels, statistics of plague and cholera, deaths from beriberi, tuberculosis prevention, photographs of infants properly and improperly cared for, and of a number of cases of plastic surgery.

The emergency hospital was equipped with cots, regimental and detachment field chests of the U. S. Army Medical Department, white enamel instrument case, washstands, bowls, chairs, and a sterilizer, and during the hours at night when the crowds were greatest an ambulance was stationed there to facilitate the transfer of any serious cases to the General Hospital.

The plumbing display consisted of a modern tiled bathroom with enamel metal siding, bathtub, shower bath with curtain, frame and base to catch the water, low-tank flush water-closet, with white enamel metal seat, washstand and foot bath, together with traps, drains, and other fittings for sinks and drains.

The sanitary houses were models constructed by the division of sanitary engineering and demonstrated the unit idea to be followed in tenement-house construction, each house being separated from the adjoining one by a party wall and having its own kitchen, water supply, water-closet, and drainage, with galvanized-iron roofs and gutters, and free through ventilation from front to back of house; this was secured by large double opposing windows in front and back walls, as well as large openings in all cross-sections of rooms to facilitate the free passage of air through all parts of the house. Each unit has its own back yard entirely fenced in by a closed type of fence, while the part devoted to the kitchen, etc., is separate from the house and connected with it by a short covered or uncovered passageway. Where upper and lower floors are occupied by separate families, each floor is a complete unit, the upper one having its own stairway leading to the street; the lower floor, excepting the passageway, is raised about 1 meter from the street level, the most striking feature being the unusually large window and door openings in both the front and back of the house. The model of the nipa house constructed especially for tuberculous persons gives a much larger comparative area of window space than is customary, and the front and back of the house are provided with large covered porches connected with the house by doors and intended for use as sleeping quarters, they being located on opposite sides and near the corners of the house to afford shelter in inclement weather.

The municipal water filter consists of a large rectangular-

shaped cement tank divided across by a wall, thus making two spaces, one about five times the size of the other. Into the smaller space, which serves as a settling bed or basin, the water enters and the overflow passes through pipes into the larger and filtering tank, this being filled with filtering mixture composed of sand and gravel; after passing through this the water leaves the tank at the opposite end and is ready for use. This filter is also divided lengthwise by a concrete wall which permits of cleaning one half while the other half is in service. The settling basin is also provided with large valves to facilitate cleaning.

The model of an artesian well consisted of a vertical section of soil from the surface down through several strata of rock, gravel, and sand, the upper or clay strata representing the polluted part, next coming the rock strata which act as a barrier against contamination of the lower sections, from which the water is obtained. A small glass pipe representing the driven well extended from the surface down to the gravel strata; through this a stream of water was kept flowing by syphonage. The perspective being a hillside, this illustrated how contamination of surface water occurs by natural drainage at a distance and at lower levels from habitations.

The sanitary privy is constructed with the object in view of (1), securing a receptacle for the excreta; (2) privacy; and (3) protection from fly infection and soil pollution. The requirements being: That the excreta must not be deposited on the ground nor animals, flies, or insects, have access to it; that its sanitary condition and the protection offered in bad weather will make it a place to be sought rather than shunned when responding to the calls of nature. The house shown in the model is square with a slanting roof and narrow screened ventilating spaces at the top, floored, door in front with coil spring, seat along the back wall with cover opening, and a small door in the back opening from the level of the seat to the ground for the purpose of removing the bucket or other receptacle of excreta for cleaning. The cover of the seat should be hinged and so hung that it will close of its own weight when the occupant rises, this to prevent flies from having access to the excreta and eliminating the element of forgetfulness on the part of the person using the closet. There should also be a small box inside to be kept filled with dry earth, wood ashes, or lime, together with some implement by which a small amount may be thrown on each stool. When one considers that dysentery, diarrhea, typhoid fever, cholera, hookworm disease, tuberculosis, Cochin China diarrhea, eelworm infection, and several other of the

commoner diseases as well as some of the rarer ones in human beings are spread largely through fly infection and soil pollution, the importance of a sanitary privy will be better appreciated.

The relief maps of Santa Monica presented very forcibly the former condition of this as well as that of many barrios with their irregular location of houses, no provision for the disposal of excreta, no drainage—with the resulting swampy and filthy condition of the lower sections—no market, and a sluggish estero serving no other purpose than the collection of filth. The model barrio showed a regular arrangement of streets and alleys with corresponding regularity and uniformity in house location, a sanitary market, midden sheds or dry-earth closets systematically and conveniently distributed, each street and alley provided with a drain on both sides into which every house is required to drain, a cement base being placed under the kitchen or back part of the house to collect the waste water and carry it directly to the street drain thus avoiding the formation of stagnant water on the premises, the street drains emptying into deep drains which communicate directly into the esteros which in turn are washed daily with tide water; when practicable, fireplugs are also used to flush out these drains. Public hydrants also are located on the side of the street where their waste water is conducted directly into the drain on a cement base.

The ice machine shown is of French make and occupies a space but 1½ meters long, 40 centimeters wide, and 1 meter high. It is intended for house use and its purpose in the Bureau is the preservation of vaccine virus at remote places in the provinces where vaccinating is being done and where ice or cold storage is not available. It is a vacuum machine, the necessary lowering of the temperature being obtained by means of the extraction of heat and moisture by the use of sulphuric acid and an air pump.

The rat traps shown and adopted are of two kinds, one a cage constructed of bronzed wire with entrance at one end and trap door in center partition and capable of holding a number of rats, the other, the wooden variety with a strong spring which upon being released by the rat touching the bait strikes the rat on the back of neck, killing and holding it. The sanitary bottles for milk, etc., are liter bottles having stoppers and carried in cheap wicker carriers in groups of four, thus preventing contamination of the contents by dust and insects and avoiding frequent handling in carrying.

The various grades of rice, both polished and unpolished (or milled and unmilled), were shown in bottles, together with the

rice pericarp, and demonstrations were given in which the polished rice was shown to be the cause of beriberi, as proven by the results of an unpolished rice diet at the leper colony at Culion, in jails, lighthouse stations, Government vessels and institutions, and among native troops of the United States Army, as reported by Dr. Heiser to the meeting of the Philippine Islands Medical Association, February 23, 1911, and the reports of the investigations of Aron, Highet, Frazer, Stanton, Kilbourne, and De-Haan. The presence of 4 per cent or more of phosphorus pentoxide is considered sufficient to class the rice as unpolished and acceptable.

The importance of this as a sanitary question is emphasized by the fact that in Manila alone during the year 1911 there occurred 1,500 deaths from beriberi which could have been prevented by the substitution of unpolished for polished rice.

The case of stuffed rats contained specimens of the *Mus rattus,* or black rat, *Mus norvegicus,* or wharf or sewer rat, and the *Mus musculus,* or house mouse, all found in the houses of Manila and capable of carrying plague, if exposed to the infection.

In specimen jars, and undergoing development, were displayed the larvæ and adult *Stegomyia persistans,* or day mosquito; *Culex fatigans,* or night mosquito; and the common house fly.

The small disinfecting pump exhibited is used to spray rooms with a disinfectant solution from a bucket. This pump is small, simple, cheap and effective, and, in addition to the purpose designated, it may also serve as a small fire extinguisher, sprinkler, and spray pump for the application of whitewash.

The history of cholera and bubonic plague was shown by charts as follows:

Cholera.

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
Cases	4,664	910	8	226	848	223	1,186	284	310	1
Deaths	3,560	810	7	225	744	194	819	227	224	1

Plague.

	1899	1900	1901	1902	1903	1904	1905	1906 [a]
Cases	1	271	485	10	198	84	45	7
Deaths	1	199	427	10	174	78	43	7

[a] None since.

The cycles of the development of the fly and the mosquito were well illustrated and represented their natural surroundings,

while the necessary means for their extermination were given as follows:

FLIES.

1. As flies breed in manure and garbage therefore bury or burn all such material.
2. Screen all food.

MOSQUITOES.

1. Bury all old empty bottles, tins, or whatever may serve as water receptacles.
2. Screen cisterns, water barrels, also manholes, ventilator tubes, and discharge pipes to vaults and sewers.
3. Drain or oil all ponds, pools, and cisterns, 150 cubic centimeters of petroleum being required for every square meter of surface, this to be renewed every one or two weeks.
4. As mosquitoes transmit malaria, filariasis, yellow fever, and dengue, destroy all breeding places and sleep under a mosquito net.

The rat flea (*Pulex cheopis*) was shown in a drawing; this flea is the common rat flea of India as well as of the Philippine Islands and transmits bubonic plague from rat to rat and from rat to man.

Tuberculosis prevention was shown by a series of comparative pictures with text:

One side showing:	The other:
1. The open and well-ventilated house with person sleeping on the covered porch.	1. A closed and poorly ventilated house, person sleeping inside on the floor with dirty clothes and cooking utensils drawing flies.
2. Cigar making in clean room with cigars screened, stationary wash-stand, good ventilation, high work tables and spittoons.	2. Low tables with girls seated on or near the floor, no spittoons, a small window affording but the poorest ventilation, and no screens.
3. Boys and girls playing lawn tennis and exercising in open air.	3. Children playing inside the house on dirty floor, no ventilation, dog eating food scattered on floor and flies abounding.
4. Eating meals on high table, clean, and with knives and forks, food screened from flies, good ventilation.	4. Eating food with fingers on low table, no screening from flies, baby and dog playing together on dirty floor, and stable just outside with direct fly communication to food.

These illustrations were shown for the purpose of teaching:

1. Sleeping with the windows open or outside means clean air, pure blood, and good health.	1. Closed windows mean dirty air, and poisoned blood. This means death.
2. Work and study in pure air makes mind and body alert.	2. Dirty dusty hot rooms are killing. Destructive to health and efficiency.
3. Play and exercise in clean open air. Keep out of doors as much as possible.	3. Indoor play and playing in dusty places is not healthful play. Exercise in dirty air is dangerous.
4. Eat clean nourishing food, protected from flies and dust.	4. Dirty food kills thousands. Flies and dust contaminate food.
5. Don't spit in public places. Don't swap gum, apples, etc. Don't put pencils or money in the mouth. Don't eat candy, fruit or pastry that has been exposed to flies or dust. Don't sneeze or cough in another's face, don't let another infect you in this way.	5. "No spit, no tuberculosis." There is spit on used gum. There is spit on pencils and filth on money. There are all kinds of germs on such.

The part of the exhibit that attracted much attention was the demonstrations on infant feeding given by one of the Filipina trained nurses from the General Hospital. The points emphasized were cleanliness and caloric or scientific feeding as now taught and carried out in the General Hospital. The demonstration showed first, the washing of the feeding bottles with clean cold water, then with hot water and soap, followed by placing in a clean pan and covering with clean cold water and boiling for twenty minutes. During this interval the nipples are to be cleaned by washing with clean cold salt water, then placed in a clean pan, covered with water and boiled ten minutes, then placed in clean cold water and covered with a pan or cloth. The dish pan should be kept for dishes only and the dish towels are to be washed in soap and water, rinsed in cold water and boiled twenty minutes, rinsed twice in cold water and then hung up to dry. Before handling any food for the baby the mother or nurse should carefully wash her hands; after nursing, the breast should be washed 3 times daily with soap and water and then rinsed with hot water. Where there is any tendency to sore mouth in the baby a mouth wash of a solution of boracic acid and honey should be frequently used.

The emergency hospital treated an average of about fifteen cases daily, both medical and surgical. Two cases of fracture,

one spinal injury, one laceration of the palmar arch of the hand, one laceration and separation of the tendons and muscles of the heel, and two gunshot wounds comprised the most serious injuries. A number of incised, lacerated, and contused wounds, as well as one case of a sting by a poisonous fish, were also attended. Among the medical cases there were malaria, dengue, parotitis, acute indigestion, ptomaine poisoning, epilepsy, syncope, and conjunctivitis from confetti lodging in the eye.

The Bureau was represented by Dr. G. I. Cullen with medical inspectors Zach Laughlin and C. E. Norris on duty at the hospital, while two American and five Filipino sanitary inspectors were also detailed.

THE EXHIBIT OF THE BUREAU OF FORESTRY.

By E. E. SCHNEIDER, *Wood Expert, Bureau of Forestry.*

The Forestry Exhibit at the First Philippine Exposition was not only larger than the exhibits at the Carnivals of the two preceding years, but in some respects was also more varied than these. Especially was this true in the case of the articles of furniture shown.

The main feature of the exhibit was, as usual, the collection of planks from the Museum of the Bureau of Forestry. These planks, ranging from less than 3 decimeters to nearly 1.22 meters in width, entirely covered the walls of the exhibit with the exception of narrow panels of green at regular intervals. On these panels were displayed maps and statistical tables interspersed with trophies of the chase and ornamental articles such as woven hats manufactured from minor products. More than seventy species of timber are represented by the one hundred and thirty-odd planks of the collection.

To many visitors the logs arranged at intervals about the walls and piled in massive pyramids about the bases of the pillars were of equal or even greater interest than the planks, as they show not only the longitudinal section, but also the cross-section of the wood, besides demonstrating the relative amount of heart and sapwood, the character of the bark, and the shape of the tree. This exhibit of logs included practically all the woods of the classified list in the Forest Manual, besides a large number of others, the total number of species shown being about 125. Excluding those duplicated between the logs and the planks, the whole number of species exhibited reached over 150.

The furniture exhibit included a number of antique specimens. One of the most interesting was a wardrobe of camagon made in Baliuag in 1811 and presented to Governor-General Rafael María de Aguilar. A round sewing table of camagon and a sideboard

made of a rather rare wood, malatapai, both dating from the first half of the past century, were also much admired. The most comment, however, was caused by the two huge one-piece table tops of lauan and dao, 2.92 and 3.10 meters in diameter, respectively. The dao table, which is the largest known in Manila, is a recent acquisition, the buttress slab from which it was made having been donated to the Forestry Bureau by Señor Jaime Serra, a Spanish resident of Masbate. Beside these tables and other pieces of furniture belonging to the Bureau of Forestry, there were exhibited a number of narra tables and other articles of furniture loaned by private parties and by merchants or manufacturers.

Of the exhibits of minor products, the most conspicuous were those of almaciga, or copal resin, and gutta-percha, the latter being shown in the various shapes—such as rolls, balls, and bricks—in which it is brought to the markets. Others shown were cabo-negro fiber, rattan (bejuco), bamboo, diliman, as well as small manufactured articles such as liquid measures, baskets, and trays made of rattan and bamboo.

Aside from the color effect of the articles exhibited, the whole scheme of decoration was in green. Beside the panels and borders of dark green bunting surrounding the planks, there were two or three score of living palms scattered about the whole area, while the walls and rafters above the planks, and the railings surrounding the exhibit, were profusely decorated with the long graceful fronds of the nipa palm. An abundance of chairs and benches were strewn about, so that the exhibit was a favorite place for foot-weary visitors to rest at once their limbs and their eyes.

The committee on awards of prizes to Insular exhibits gave the second prize, a silver cup, to the Forestry Exhibit.

THE EXHIBIT OF THE BUREAU OF PRINTING.

By Benj. P. Lukens,
Acting Statistician, Bureau of Agriculture.

On entering the Exposition grounds from the Luneta, one's attention was immediately drawn to a small square building whose front bore an imposing electric sign reading "Bureau of Printing." The building was so arranged with overhanging roof and open sides that visitors could walk around the pavilion and see all the displays without exposing themselves to the sun or rain and without disturbing the employees who were operating the various machines and printing devices. In addition to these employees there were always several of the Bureau's foremen

within the inclosure who explained the work that was being done and answered any questions that were asked.

The object of the exhibit was to reproduce in miniature an up-to-date printing establishment and to show by comparison the rapid strides that the art of printing has made in the last twenty or thirty years. As far as practicable the old and new methods were exhibited side by side so that the speed and efficiency of the modern appliances were self-evident to the most casual observer.

Every division of the Bureau was represented and most of the work performed was in execution of work orders being filled for various branches of the Insular Government. The labor was identical with what is ordinarily performed within the inclosure of the Bureau's printing plant and was instructive to all classes of spectators whether they were or were not technically informed as to the details. The operators of the machines and the other workmen engaged in the different processes were all young Filipino men who entered the Bureau several years ago as apprentices and have gradually been elevated to their present positions.

The power for the operation of the machines was produced by a small dynamo driven by an alternating-current motor generating about 5 horsepower. Each machine was driven by a direct motor receiving its electric current from the dynamo. This part of the exhibit was in charge of the young men from the power-plant division.

The composing division had a couple of men "setting type" by hand from the old-style "cases" and at their back was a young Filipino operating a "linotype." To those not familiar with this machine it may be well to make a brief description of it. The operator sits in front of a keyboard somewhat similar to a typewriter. By pressing the keys he releases the individual matrices, or letter molds, and they slide down long grooves into their proper position in the line which is being "set up." When the line is completed, molten type-metal is run into the matrices and a line or "slug" is cast containing all the letters which were struck on the keyboard. The original matrices are then lifted to the top of the machine and moved along the top of the type grooves until each letter drops into its own place and is again ready for use. The lines of type are arranged in columns at the side of the operator and are then ready for the taking of a "proof." By this machine the type is "set up" many times faster than by the old hand method and no time is lost in "distributing" or returning the types to their boxes.

Two printing presses were shown by the press division. The "Gordon" platen press was fed by hand and could make 1,000 impressions an hour. The "Harris" press was rotary and had an automatic feeding appliance; it made impressions at the rate of 10,000 an hour. The two machines were printing official envelopes and the work of the "Harris" press was so rapid that it kept one man busy merely to stack up the envelopes in piles preparatory to their being counted.

An interesting feature of the photo-engraving section was an exhibit showing how, by first printing an outline in yellow, then printing over it in red, then following that by an impression in blue, and then finishing in black, a picture was produced showing the delicate shading that usually requires the hand work of a practiced artist. In this section were also displayed some excellent half tones in black and white showing views taken in different parts of the Philippines. Some of the employees of this division were working on the plates of this class of work, cutting away the surplus metal and bringing into clear relief the fine lines which would receive the printer's ink.

The foundry division had men demonstrating the process of electrotyping. Impressions of the type were taken in wax. This wax was then treated with graphite, placed in a solution of copper, and by the process of electrolysis a copper shell was formed, reproducing all the lines of the original type. This shell was then backed with type metal and trimmed and leveled into suitable shape for mounting on wood.

The process of sewing the leaves together to form books was shown by the bindery division. Several young men were seated around a table sewing by the old hand method. In front of them was one of the latest machines for doing the same work. It seemed almost human in its reaching out for the leaves, doubling them, piercing them with binding thread, and placing them in proper position in the volume being bound. The speed, accuracy, and cheapness of the operation of the machine in comparison to the hand method was notable. The bindery had several employees assembling large account books and showing the process of finishing and lettering these huge volumes. In this section were exhibited several volumes whose edges were artistically decorated in gold leaf which was worked by hand into designs representing portraits and scenes executed in minute detail.

The section of the printing exhibit which seemed to attract most attention was that part of the bindery work devoted to marbling. Doubtless many who watched this interesting process had often wondered how the edges and inside covers of books were printed with such curious designs of spots and curves of gaudy

colors. The process seemed simple enough, although it was evident that great care, skill, and practice were necessary to avoid blotting or blistering the sheets that were being colored. A small trough was partially filled with a viscous solution which served as a body upon which to spread the colors; the different colors were dropped on this surface in spots very generally distributed; the colors were then pulled into long streaks or lines by means of a metal comb; then with a small wire the workman moved the colors into circles, waves, or spots to suit his fancy. When the design was finished he laid a sheet of paper carefully on the part to be printed and with equal care removed it showing a reverse reproduction of the colors as they lay. By means of a metal scraper the colors were then dragged off the solution and it was again ready for a new design to be worked on it. There was always a crowd of interested spectators at the side of this marbling trough and as no two designs in marbling are exactly alike, they were given a constant variety of entertainment.

On suitable shelves the Bureau exhibited books showing the different styles of binding from the cheapest to the most costly. Conspicuous in this group was the special material which the Bureau has recently introduced. This material is the result of about eight years of experimenting and has proved to be immune to the attacks of cockroaches. It has almost revolutionized the trade as far as cloth binding is concerned and came near to putting some dealers out of business. Letters of inquiry are continually coming to the Bureau requesting further details of its composition and service, and printing journals state that it is rapidly being adopted as a standard binding.

In summing up the Bureau's exhibit, attention must be called to the skill and efficiency of the young Filipino employees. Most of these men have learned the printer's trade entirely within the walls of the Bureau's plant. They show the result of a carefully prepared system of instruction which is being maintained by the Bureau in all its divisions. In fact, the Bureau is placed under the jurisdiction of the Secretary of Public Instruction largely because of this educational feature. The idea of instruction is never lost sight of and the employees are being constantly improved in their individual work. Many of them have been able to leave the Bureau and obtain lucrative positions in commercial printing houses. While remembering that the Bureau of Printing has an international reputation for equipment and quality of work, let us not forget that it is one of the most practical educational institutions in the Philippines.

THE EXHIBIT OF THE BUREAU OF EDUCATION.

GENERAL EXHIBIT.

By Luther Parker, *Bureau of Education.*

The scope of the exhibit of the Bureau of Education at the Exposition of 1912 was as comprehensive as the general public-school system. In fact, the original plans for this exhibit called for a representation display of the best industrial work from each school in these Islands having three or more grades.

Approximately 16,000 exhibit tags were shipped out to the several school divisions for distribution among their schools, and nearly all of the tags were used on articles of value made by the pupils of the schools during the past year.

A series of preliminary local exhibits, held in the town and provincial centers before the Insular show, was a factor in the selection of the articles to be sent on to the Exposition. In many provinces these local exhibits were the means of arousing a great deal of enthusiasm among the patrons of the schools and interesting them in the industrial work of the pupils. Reports received by the Bureau of Education from provinces where this idea was fully carried out were very satisfactory and encouraging. They demonstrate at once the real value of interesting the public in that phase of school work that has for its aim the fitting of a people for economic independence through the practical scientific training of the child to advantageously apply himself to the production of useful and salable articles.

It is conceded that the Philippines are essentially an agricultural country, and there is here, as in all agricultural communities, an abundance of spare time that can be used to advantage in the handicrafts. The Filipinos are a people eminently painstaking, and they are capable, under proper direction, of quite sustained effort in the making of articles requiring patience and care in their production.

Given such conditions, and the urgent necessity for increasing the per capita production of wealth, the schools find presented a problem that is new in the educational world and well worthy of the best consideration by educators in the United States as well as in the Philippines. Not only is the subject of interest to educators, but to students of economics and statesmen as well; the results of such teaching as is being given by the schools of the Philippines at the present time will be so far-reaching in their effects as to merit the closest consideration of those interested in the future of the Philippines, economically and politically.

The character of the exhibit gives promise of a distribution of work during the next year far wider and better than had even been anticipated. Several provinces in which special effort has been made along definite lines have set standards that will be of great value to the Bureau of Education in its effort to standardize the work generally.

The provinces most worthy of mention in this connection were Albay with its exhibit of Irish crochet work and basketry, and Sorsogon with its basketry exhibit.

The various trade and manual-training schools presented exhibits which indicate a very gratifying progress. Especially notable were the exhibits from the trade schools of Manila, Sorsogon, Pangasinan, Iloilo, and Pampanga, all of which had first-class articles that received the unqualified approval of the public. This fact was demonstrated by the sale of practically everything offered from the above-named schools.

The improvement in the character of the work in general over that submitted last year, and the practical approval by the public as shown by the sales returns, have demonstrated beyond question that with proper attention by the directing, superintending, and supervising forces of the Bureau of Education in the development and perfection of new lines of industry, the Philippine Islands will be enabled in a very few years to export handwork of a high grade and in large quantities. This will be brought about by the training of boys and girls in the higher grades of the public schools to specialize along those lines of industrial work that will utilize the wealth of raw materials with which the Islands have been so bountifully provided.

It is evident from the exhibition just past that in their handwork the girls and women of the Philippines can vie with the women of any country, and the imagination fails to grasp the possibilities of production and export, under favorable tariff conditions with the United States, of the fine laces and embroideries which can be turned out in a few years when the school girls of the present have homes of their own and use their spare time in the production of fine work learned in the schools.

The value of all the articles sent to the Exposition from the various provinces amounted in round numbers to ₱26,000, of which over ₱18,000 worth were sold, the balance being returned to the respective provinces. In addition to the values mentioned above, the Philippine Normal School, the Philippine School of Arts and Trades, and the schools of the city of Manila sold articles to the value of an additional ₱8,000, making the grand total of sales over ₱26,000. A large part of this amount goes

directly to the pupils who accomplished the work; in cases where the pupil furnished the material himself, he collects the total amount received for the article sold.

A system of accounting has been devised, with the approval of the Insular Auditor, by which the money received from sales at the Exposition is returned to the owners and receipts are taken therefor; this arrangement provides a satisfactory system of accounting.

It is the intention of the Bureau of Education to extend the industrial work during the coming school year to every school in the Philippine Islands under its jurisdiction. By means of a carefully graded course of industrial work, which is now being outlined by committees of the teachers best qualified for the work, it is the purpose to introduce into the homes of the townspeople such industries as are fitted to the localities in which they live and which are adjudged to be of most value economically to the particular sections.

In all this extension of school industrial work, however, the vital fact that the psychological and moral development of the child is paramount is kept constantly in mind, and the course of study in industrial work is so planned that while its execution will better fit the child for handwork by which he can make his living, the child's development is still placed before the development of those special industries which follow as a natural result of the steps taken in carrying out the course.

VEGETABLE AND FARM EXHIBIT OF THE BUREAU OF EDUCATION.

By NORTH H. FOREMAN,
Inspector of School Gardens and Sites.

A complete review of the vegetable and farm exhibit of the Bureau of Education at the First Philippine Exposition held in Manila, February 3 to 10, 1912, is not being attempted in this paper, several of its most prominent features only being noted. The exhibit was composed entirely of garden and farm products raised by school children, mostly in the primary grades. There was no attempt to make a complete exhibit of Philippine products. The sole object was to interest the visiting teachers, pupils, and general public in the agricultural activity of the schools.

The exhibit was composed of contributions from gardens in the Provinces of Union, Albay, Pampanga, Batangas, Pangasinan, Bulacan, Tarlac, Bataan, Nueva Ecija, Tayabas, Camarines, Capiz, Rizal, La Laguna, Zambales, the Philippine Normal School, the Manila city schools, the school farms at Muñoz, Batac, and Indang, and the Tanauan school nursery. The fact that

Photo by Bruce Ingersoll, B. of E.

PLATE IV.—A GENERAL VIEW OF THE VEGETABLE EXHIBIT, BUREAU OF EDUCATION.

the exhibit came from sixteen provinces and represented five hundred individual contributors, living in more than eighty different municipalities, will indicate in a measure the scope of the work. It is also interesting to note how rapidly the work is reaching the people. In the Provinces of Albay and Union 74 and 64 per cent, respectively, of the individual contributors furnished vegetables from the home gardens of the pupils.

The details of the different kinds and varieties of vegetables submitted would exceed the object of this article; the leading features only are reviewed herewith.

Classes of products exhibited.—Grouping them roughly, it might be stated that the following products were displayed: Leaf vegetables, 7 kinds; fruiting vegetables, 3 kinds; foreign roots, 7 kinds; native roots, 10 kinds; legumes, 6 kinds; vine crops other than legumes, 8 kinds; grains, 6 kinds; forage, 2 kinds; other farm crops, 4 kinds; fruits, 6 kinds; tree seedlings, 10 kinds.

Prize exhibit.—A Manila merchant, who is interested in the extension of garden work in the Philippines, provided a group of excellent prizes for a vegetable contest, the prizes to be awarded under conditions prescribed by the merchant and by the Director of Education, under seven classes. The excellent quality of the tomatoes, peppers, eggplants, and cabbages exhibited in this contest was a keen surprise, and the source of much favorable comment and admiration from the general public. Mr. O. W. Barrett of the Bureau of Agriculture, Mr. W. F. Montavon of the Bureau of Education, and Mr. A. M. Darley of Manila acted as judges for the contest, and the prizes awarded were distributed widely among the schools of the Philippines.

Corn.—A corn contest, the first ever held in the Philippine Islands, was a part of the exhibition. The twenty competitors represented twelve provinces. It was the beginning of what should be a leading feature of subsequent expositions.

Forage.—Three kinds of forage were sent from the Central Luzon Agricultural School. This exhibit received the special attention of Army officers.

Yams.—The exhibit of yams, or camotes, while it did not attract the attention that such an exhibit should receive, was excellent. This product, which excels the Irish potato in food value, is an example of what can be grown in Philippine gardens.

Nursery.—The Tanauan Intermediate School exhibit of tree seedlings showed what is being done in many schools to further the growing of trees of economic value.

Green peas.—The green peas and young potatoes exhibited

from the Indang farm indicate that the time may not be far distant when the general public can be supplied with these vegetables.

Few persons not familiar with the work of the Bureau of Education have any conception of the extent to which gardening is now becoming the solution of the important problem of more good wholesome food for the people. Recognition of the fact that questions of the seasons and of transportation form no small feature of vegetable exhibits, and that the contributors were school boys, doing work in the main new to their fathers as well as to themselves, makes the showing even more creditable.

To the Bureau of Agriculture is due great credit for its liberality in filling the requests of school pupils for seed; it has played an inconspicuous but very valuable part in the success of this exhibit.

THE BUREAU OF SCIENCE EXHIBIT.

For the previous Carnivals, the Bureau of Science has provided exhibits that were more elaborate than that just displayed at the First Philippine Exposition held in 1912, but none have been rewarded with more public enthusiasm. Unfortunately many of the lines of work of the Bureau of Science will not lend themselves to exhibition purposes, but in spite of this the exhibits were varied, and foremost among them were demonstrations of the industrial operations of mining, fisheries, and silk culture.

The culture of silk was of exceptional popular interest. Racks supporting trays of silkworms in all the different stages of their existence, together with baskets of the mature cocoons, formed one part of this exhibit. The different varieties which have been most successfully propagated in the Philippines, namely, the Bengal-Ceylon and Philippine hybrid (Bengal-Japanese) and the Eri castor-plant worms, were shown and arranged on feeding trays so that special attention might be called to each of them. Fortunately it was also possible to show the emerging of moths from the cocoons and the subsequent deposition of eggs. Other portions of this exhibit had to do with all phases of spinning, and the reeling of silk on a hand reel such as is used by the Japanese in their home silk industry. Three Filipino women were the demonstrators in this work. Two others demonstrated the Philippine method of reeling silk on bamboo spools for use in weaving. A loom was on the ground and set up ready for use, but unfortunately the time was so short that it was not possible to reach this state of the industry.

More than a century ago mulberry bushes (*Morus alba* Linn.)

and silkworm eggs were imported into the Philippines, but for lack of financial backing no successful industry was established. Friends and employees of the Bureau of Science imported eggs a few years ago from Japan as well as Ceylon. These were hatched and the worms grown at the Bureau of Science but they produced silk inferior in both quality and quantity. A hybrid between the Japanese and Ceylon varieties was produced which has proved to be very satisfactory, as it produces from eight to nine generations annually. Other countries usually can not produce more than two generations yearly, therefore the Philippine hybrid affords an excellent and profitable prospect for sericulture in these Islands.

The geological, mining, and metallurgical work of the Bureau was shown to a very great advantage. For the first time all the geological maps of the Archipelago were brought together in one large relief map showing the mountains, plains, and all the major features of Philippine geology. This map represents the accumulated data of over thirty years' work, the major portion of which has been performed within the past ten years by the division of mines, Bureau of Science, of the Government of the Philippine Islands.

There were exhibited separate relief models showing the physiographic features of the various better known mining districts. Gold bars showing graphically the production of the dredges of the Paracale district and of the mill of the Colorado mine attracted considerable attention.

A model showing the method of underground working in gold mines was exhibited as a supplement to that exhibited at the previous Carnival which showed the method by which gold is extracted. Another very instructive model was that of a coal mine showing the various stages of development and illustrating the manner of mining coal.

A representative collection of Philippine rocks and minerals were displayed, above which were hung charts showing their economic distribution. In the Philippines there are large deposits of placer gold which have been worked for years and in addition hundreds of square kilometers of promising ground which will some day be exploited. At present two dredges are operating in the Archipelago, two are being built, and three more have been ordered. Gold-quartz veins are also very abundant and have been worked for hundreds of years in a small way. One mill recently started is producing gold worth about ₱2,000 per day.

Large deposits of iron, copper, manganese, and coal can be

found in many localities. Some of these have been successfully worked only on a small scale though they present very extensive possibilities.

A very interesting display was that of the outfits used for catching big game fishes. These outfits displayed in a glass case consisted of rods, lines, hooks, spoons, land nets, gaffs, etc. As a graphical suggestion of the sport to be had in big game fishing in Philippine waters, four large fish, caught during the past year on exploration trips to waters south of Manila, were mounted for exhibition. The varieties shown were a Spanish mackerel, weight 30 kilograms, caught near the coast of Leyte; a jewfish or sea bass, weight 60 kilograms, caught at Meander Reef; an ocean bonito, weight 21 kilograms, caught at Apo Reef; and one giant pompano, weight 22 kilograms, caught off the coast of Palawan. Sea game fishing in the Philippines offers unlimited possibilities both from the standpoint of sport and that of commercial exploitation. Very favorable comment was elicited by the display of exceedingly beautifully executed colored drawings of Philippine fishes.

A very interesting and instructive exhibit was that of the products of oranges and coconuts. Generous samples of coconut oil, both crude and refined, and of soap manufactured from the same were valuable in showing the great possibilities of this industry. Samples of both sun-dried and kiln-dried copra were included in this exhibit. Fourteen bottles of orange juice produced from 100 oranges, orange peel, and paper manufactured from orange pulp were of special interest and suggest new Philippine industries.

Specimens of sand-lime brick in two sizes manufactured from Philippine materials were also displayed. These bricks, owing to the method of manufacture and hardening, are not in any sense ordinary mortar bricks although they are made of a mixture of siliceous material and hydrated lime. Properly manufactured sand-lime brick withstand exceedingly severe tests. When heated to a high heat and suddenly plunged into cold water they undergo no change. They promise to be a very satisfactory building material for the Philippines as there is no doubt of their strength and durability. They would suffice for a structure very much higher than is ordinarily built in the Archipelago.

There was included in the Bureau of Science exhibit a liberal display of the various publications of the Bureau of Science which gave the public an opportunity of which they eagerly availed themselves to become familiar with some of the very interesting printed matter published by the Bureau.

THE EXHIBIT OF THE BUREAU OF INTERNAL REVENUE.

By F. C. KINGMAN, *Agricultural Inspector.*

Due to the efforts of the Bureau of Internal Revenue, and to the cordial coöperation accorded that office by its internal-revenue agents and by the provincial and municipal treasurers, the consumption of denatured alcohol in the Philippine Islands within the past year has nearly doubled. From a consumption of 275,000 gauge liters in the year 1910, there has been an increase to 525,000 gauge liters during the year just closed, 1911. It is the sincere desire of the Bureau that it may have the same support and coöperation, in the introduction of this comparatively new commodity, in the future, as has been given during the past year. The uses of denatured alcohol are many and varied, and actual practice has shown that the feasibility of using it as an illuminating fuel is entirely satisfactory, both from the standpoint of efficiency and economy. The experience of the municipality of Boac, Marinduque, bears out the above statement. This municipality has had in operation since December 8, 1911, 6 "Saekular" 150-candlepower alcohol street lamps, which were purchased from G. Martin, Manila, for ₱75 each. These lamps have given entire satisfaction, and aside from giving a much better light than the higher power lamps installed in Lucena, Tayabas, they have, up to date, February 29, 1912, been operated without breakage. Various officials of Lucena have inspected the lamps in Boac, and a movement is now on foot to install such lamps in the former town. The foregoing instance goes to show the popularity of the alcohol lamp, when once its merits are made known.

Credit for the installation of these lamps is due the Manila office, and the municipal treasurer of Boac as well in bringing to the attention of the municipal council the various circulars issued by the Bureau on this subject.

The exhibit of the Bureau at the First Philippine Exposition, in charge of Internal Revenue Agent D. C. Fisher, gave a practical demonstration of the various uses to which denatured alcohol may be put. Different-powered lamps, suitable for lighting large interiors, or for lighting streets, parks, or plazas, various classes of cooking stoves, alcohol gas stoves, chafing dishes and accessories, coffee percolators, tea-balls, tea pots and urns, table kettles, small alcohol burners, suitable for heating water and making coffee or toast, were all on exhibition, and were actually demonstrating what they could do.

For the use of the above-named utensils the Bureau is indebted to the following-named Manila firms, viz: Milton E.

Springer Co.; H. E. Heacock & Co.; Wright Furniture Co.; Bazaar Siglo XX; Wm. H. Anderson & Co.; El Plenilunic, and G. Martin.

The denatured alcohol necessary for demonstrating the various lamps and burners was kindly donated by the following-named Manila manufacturers: Ayala & Co.; Compañía General de Tabacos de Filipinas; Tuason, Legarda & Co.; Destileria Lim Tauco; Lo Seng & Co.

Various tests of alcohol lamps and stoves, giving the amount of fuel consumed per hour and cost of same, have been made by the Bureau, and the following data give the results obtained:

LAMPS TESTED SINCE LAST MARCH.

Alcohol used: Denatured by Formula No. 1, 94 per cent, or 188 proof; cost, ₱3 for 15-liter demijohn, or 20 centavos per liter.

1. Hawkins "Sinumbra," 100-candlepower street lamp, consumes 1 liter of fuel in 13 7/12 hours; cost per hour, 1.4 centavos.
2. "Saekular" 300-candlepower street lamp, consumes 1 liter of fuel in 4 1/3 hours; cost per hour, 4.6 centavos.
3. "Saekular" 150-candlepower street lamp, consumes 1 liter of fuel in 7 1/2 hours; cost per hour, 2.6 centavos.
4. "Clara" 100-candlepower street lamp, consumes 1 liter of fuel in 18 2/3 hours; cost per hour, 1.07 centavos.
5. "Clara" 2-burner 200-candlepower street lamp, consumes 1 liter of fuel in 8 2/3 hours; cost per hour, 2.3 centavos.
6. Milton E. Springer Co., 100-candlepower street lamp, consumes 1 liter of fuel in 14 hours; cost per hour, 1.4 centavos.
7. Various house lamps were tested, candlepower ranging from 60 to 100, cost varying from three-fourths to 1 1/2 centavos per hour.

STOVES TESTED SINCE LAST MARCH.

Fuel used: Denatured alcohol by Formula No. 1, 90 per cent, or 180 proof; cost, ₱2.50 per 15-liter demijohn, or 16 2/3 centavos per liter.

1. Universal alcohol stove, consumes 1 liter per burner in 3.6 hours; cost per burner per hour, 4.6 centavos.
2. Pyro alcohol stove, consumes 1 liter per burner in 3 5/12 hours; cost per burner per hour, 4.8 centavos.

The Bureau has also made tests comparing the relative efficiency of alcohol and gasoline for power purposes, the results of which have been published in Bureau of Internal Revenue Circular Letter No. 373. A copy will be furnished by the Bureau, upon application.

Those desiring further information regarding the uses of denatured alcohol should communicate with William T. Nolting, Collector of Internal Revenue, Manila, P. I.

THE BUREAU OF AGRICULTURE EXHIBIT.

THE AGRICULTURAL-HORTICULTURAL EXHIBIT.

By SAM. H. SHERARD, B. SC., *Agricultural Inspector.*

Situated at the lower end of the provincial exhibits and near the machinery building, surrounded by alternate rows of large and small *bunga* palms, interspersed with shrubbery, the agricultural and horticultural products of the Islands were very effectively displayed in a *sawale* building 45 meters long by 20 meters wide.

Running the entire length of the exhibit were double rows of posts and large *bunga* palms which divided the building into eighteen sections, each 5 meters wide and 3 meters deep, and containing a complete display of some one agricultural product.

Near the main entrance was an ornamental bed of palms and smaller plants with a background of long asparagus ferns and white orchids in pots.

There were six booths down the center aisle of the building, each 1.82 meters square, and 2.43 meters high, placed opposite the sections on the side, and each representing one of the staple crops found in the Philippines.

In the center of the building, near the side entrance, was a fountain 3 meters in diameter, surrounded by maidenhair ferns and filled with lotus flowers exhibited by the Luzon Floral Co.

The sections opposite the fountain were banked with ornamental plants and orchids.

The first section on the right of the main entrance to the building contained a collection of photographs of breeding animals belonging to the Bureau of Agriculture, including native, Arabian, American, and mestizo stallions, together with illustrations of types of carabaos and cattle; a rinderpest map with a chart hung from the wall and illustrated by the use of small black and white pins where rinderpest existed a year ago, and where it exists to-day. This map showed that on July 1, 1911, there were 81 towns known to be infected with rinderpest, while on February 1, 1912, there were only 28 towns known to be infected with the disease, a gain of 53 towns. In this section there was also a collection of Bureau of Agriculture bulletins and pamphlets, sets of the AGRICULTURAL REVIEW and bulletins and Yearbooks from the United States Department of Agriculture, all for free distribution. A chart representing the organization of the Bureau of Agriculture was also shown in this section.

Opposite this section, the College of Agriculture displayed

fruits, vegetables, silk cocoons, a herbarium of local economic plants, and charts showing the lines of work in which the college is interested.

FIBER.

The sections adjoining the displays just described were filled with fibers and products made therefrom. In the center of the building opposite the fiber sections was the abacá booth, which was covered with fine grades of this fiber from the Wilson Plantation Company. Here were shown specimens worth ₱24 per picul and grading 200 per cent over good current; also samples from Indang, Cavite, showing knotted fiber worth ₱32 per picul. A table in the abacá booth contained small bales showing the different commercial grades of Manila hemp, together with samples of cotton, kapok, knotted abacá fiber, and various grades of abacá and piña as prepared for the loom. Philippine silk and eleven samples of Manila hemp rope from the Johnson-Pickett Rope Factory showing oiled, dry, and navy grades were also exhibited.

In the fiber sections were shown sixteen samples of abacá representing the standard grades; samples of maguey, sansevieria; cotton, white, dark brown, and light brown; piña and abacá for textile purposes; maguey and sisal, machine and hand-stripped; banana fiber prepared for weaving in the natural color, and dyed; samples of cabo negro and matting straw were also displayed; textile abacá cloth (pinocpoc, sinamay, and other coarse material used for lining ladies dresses); different grades of knotted fiber and some prepared for the loom; grades of piña, pure and mixed with silk and cotton, showing the different kinds of weave; also samples of fiber prepared for the loom; first, second and third grades of banana cloth; Philippine cotton cloth, showing blankets, towels and fiber in different stages of preparation; two grades of maguey cloth; two belts of bark fiber together with pineapple, maguey, sansevieria, and sun hemp plants growing in tubs.

In this section were also found five grades of buri mats, fancy and plain; ticog mats; four grades of Moro mats, Lanao weave; four grades of Bohol weave; four grades of Samar weave, both plain and fancy; sabutan mats, four grades; grades of ordinary pandan; also two grades of buri mats, which are generally used as sail cloth for native boats and are prepared from the epidermal layer of the buri palm. There were also shown nine grades of buntal hats (Lukban), with the fiber in different stages of preparation, and cigar and cigarette holders made of the same material; eight grades of Calasiao hats, a cigar holder, and

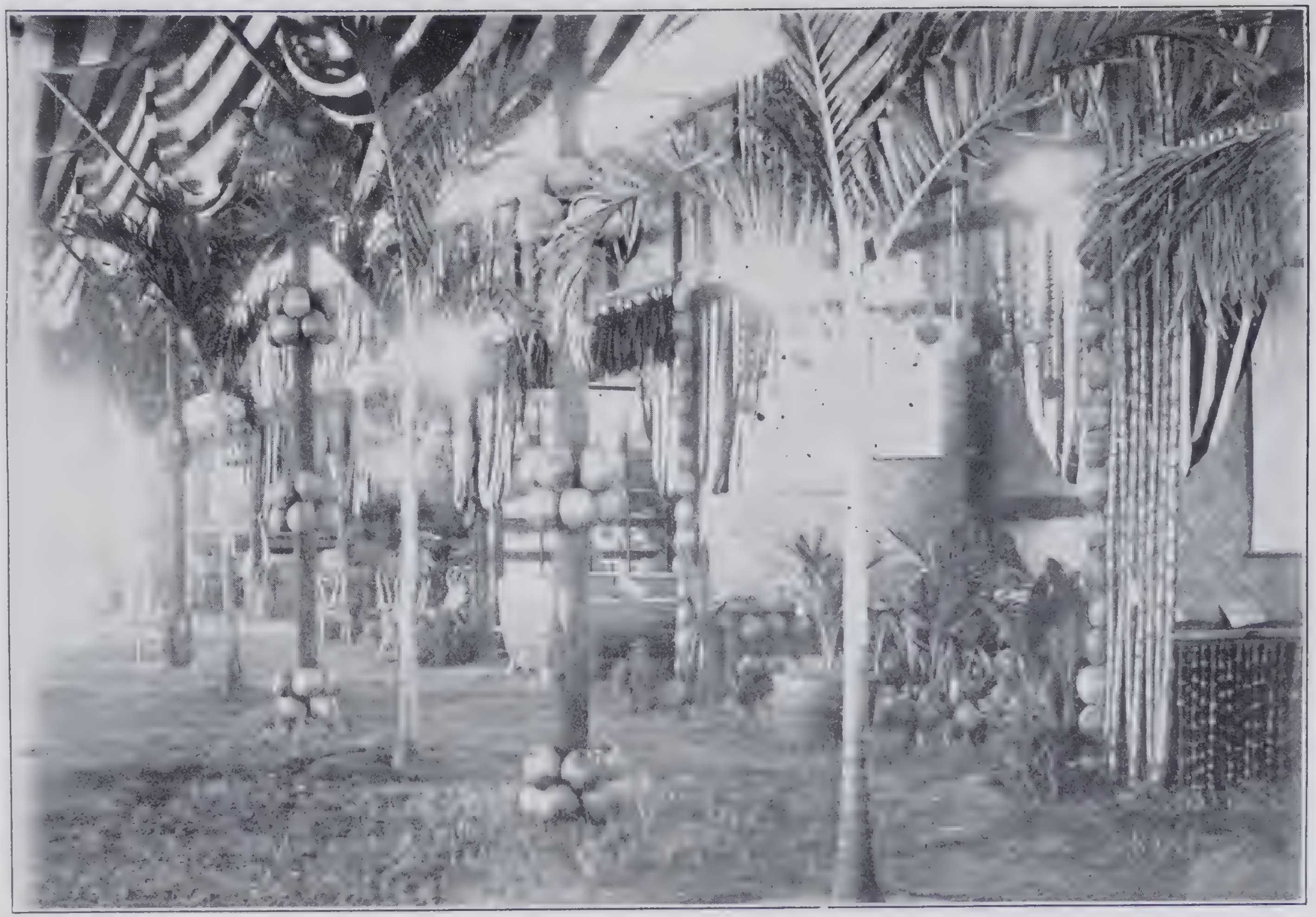
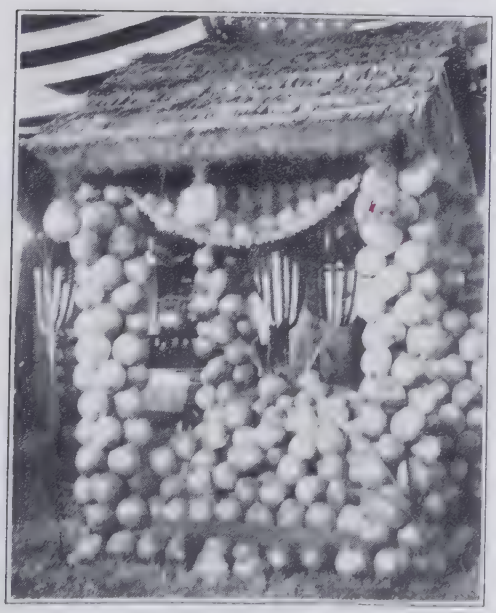


PLATE V.—INTERIOR VIEW, AGRICULTURAL-HORTICULTURAL BUILDING, FIRST PHILIPPINE EXPOSITION.

FIBER BOOTH.

RICE BOOTH.

CORN BOOTH.



COCONUT BOOTH.

SUGAR-CANE BOOTH.

PLATE VI.

samples of fiber in different stages of preparation; three grades of bejuco (rattan) hats and cigar holders together with fiber in different stages of preparation; fourteen grades of bamboo (Baliuag) hats, a cigar holder, and samples of the fiber for making hats; ten grades of sabutan hats, with fiber; eight grades of buri-leaf hats with fiber; four grades of nito hats with fiber; eight hats made of nito, bamboo, and buri; hat made of ticog grass; two grades of pandan hats together with a collection of instruments used in making hats. This collection of hats and hat-making material is the most complete in the Philippines, and is on exhibition at the main office of the Bureau of Agriculture.

There were also specimens of hand-made rope, and harness made from abacá, cabo negro, buri, etc., together with matting straw made from ticog, pandan, buri, abacá, and sabutan fibers.

A map showing those provinces in which abacá thrives best formed part of the fiber exhibit, and with the chart which gave statistics on abacá exportation, etc., the visitor was able to get valuable data on Manila hemp.

FORAGE.

Section No. 3, on the right, contained a collection of forage samples grown under the encouragement of Colonel J. C. Gresham, near Army posts. In this exhibit were found specimens of the following forage plants: Guinea grass, both green and baled; native hay; Rhodes grass; Sudan grass; Pará grass; Italian rye grass; sorghums; pea-vine hay; peanut hay; corn-blade fodder, and Brazilian grass. The following farmers had samples of forage in this exhibit: Charles Schück, Jolo; Albert F. Keil, Parang, Cotabato; John Logan, Bayambang, Pangasinan; Pablo Tan, Ormoc, Leyte; Colonel Wood, San Pedro Tunasan, La Laguna; G. W. Boswell, Parang, Cotabato; San Ramon Farm, Zamboanga; R. T. West, Malabang, Lanao; W. M. Wheeler, Malabang, Lanao; Leandro Reyes, Biñang, La Laguna; A. B. Clemmer, Parang, Cotabato; José Villanueva, Camp McGrath, Batangas; P. Von Krebs, Camp Downes, Leyte; Martin Cavanaugh, Dolores, Leyte; R. K. Netherlands, Nolsen, Pangasinan, near Camp Gregg; Major L. F. Garrard, Camp Overton, Mindanao; Lieutenant George P. Tyner, Jolo.

The Bureau of Agriculture had a very creditable collection of forage from the Alabang stock farm and the Singalong experiment station: From Alabang, Guinea-grass hay baled, one year old; native hay baled, one year old; Rhodes grass, baled one year; Sudan grass, baled one year, and sorghum; from Singalong,

specimens of growing Guinea grass, Rhodes grass, and Pará grass, together with a shock of extra good Mexican June corn. Señor M. Magno, from Tagig, Rizal, had a good collection of barili grass shown both baled and growing.

CORN.

In the section next to the fiber, on the left side of the building, corn was displayed. Here were exhibited 500 ears of selected native flint, both white and yellow, and Mexican June—a dent corn introduced by the Bureau of Agriculture. These specimen ears were grown at the Singalong experiment station and in the Provinces of Cebu, Iloilo, Bulacan, and La Laguna. Charts giving the yield of corn by provinces, and illustrating the selection of seed corn were displayed, together with a map showing the distribution of corn over the Islands and photographs illustrating the different stages of corn growth. A seed-corn tester and a device illustrating the depth to plant seeds were also shown here with information as to their use; a large ear of corn 1.21 meters in length by 30 and 46 centimeters in diameter, made from native yellow flint corn, was shown. Opposite the corn section in the center aisle, corn was displayed in the shock, unhusked and husked, making a very pretty booth.

RICE.

Next to the forage section on the right and the corn section on the left, rice was shown in the stalk and in the hull. The section adjoining the forage section contained 358 varieties of upland rice grown by the Bureau of Agriculture at the Lamao experiment station. Here was also shown a good specimen of irrigated rice from San Miguel, Tarlac. The threshed rice was shown in small boxes 18 by 15 by 9 centimeters, each box containing one liter of rice. On the walls were cases filled with samples of rice, together with maps, charts, and photographs giving rice data. A card index of each variety, with all available information, was displayed. In the opposite section 409 varieties of lowland rice, also grown by the Bureau of Agriculture, from the Alabang stock farm, were exhibited. There was a liter sample of each variety, displayed in small boxes; a card index giving all available data was in the exhibit. In the center aisle, opposite the two rice sections, was a booth made of "Palay-Iloco" in the sheath and hulled.

Two models of rice mills were displayed—one a water mill and the other run by hand.

ORNAMENTALS.

Next to the rice section, on the right, was a side entrance to the exhibit. Flanking this entrance were potted ornamental plants and immediately in front was the fountain; opposite this was a section filled with beautiful potted plants and orchids.

The ornamental plants were exhibited by William S. Lyon, Agapito Sanchez, Regino Fermin, and the orchids by several private parties; a large collection of tree ferns came from the Lamao experiment station. The Luzon Floral Company exhibited a collection of garden and flower seeds, and specimens of growing pineapples; they also decorated the fountain with lotus flowers and maidenhair ferns.

VEGETABLES.

In the section next to the side entrance on the right the following vegetables were displayed: Two varieties of radishes, peppers, red, green and yellow, batao, tugui, arrowroot, gabe, sincamas, sweet potatoes, both native and American, patola, ubi, tomatoes, celery, pechay, American peas, cabbage, leeks, cigarrillas, string beans, native peas, sitao, ampalaya, two kinds of eggplants, cucumbers, tabungas, three kinds of musk melons, two kinds of water melons, uyo, pumpkins, and squash.

FRUITS.

Adjoining the vegetable section the following fruits were shown: Roselle, guava, two kinds of mangos, two kinds of breadfruit, chico mamey, mabolo, sweet carambola, pomegranite, casoy, jakfruit, pineapples, custardapple, chico, edible banana flowers, guanábano, limes, Mandarin limes, lemon, sour oranges, Mandarin oranges, manzanita, macopa, camias, soursop, cabuyao, lemons (poi-poi), calamondin, tizon orange, papayas, pomelos, tamarinds, cacao, and 11 kinds of bananas. Samples of annatto, Liberian coffee, cacao pods, peanuts and ginger, together with a sample of rubber from the La Carlota experiment station, were also on exhibition.

TOBACCO.

Just opposite the vegetable section, in the center aisle, cigars, cigarettes and tobacco were exhibited in a glass case 1.83 meters square and 2.44 meters high. These articles were loaned by the leading tobacco manufacturers in Manila.

In a section to the left of this booth, the different grades of tobacco were shown. Here also several young ladies gave de-

monstrations of cigarette making. A map, table of statistics and photographs showing tobacco in different stages, were also in this section.

COCONUTS.

Coconuts were displayed in a booth next to the tobacco case. Here were shown nuts from La Laguna, Palawan, Mindanao and Cebu. Copra, coconut fiber, oil, and articles made from the shells were exhibited, together with photographs, statistics and a map showing the distribution of the nuts over the Islands.

SUGAR CANE.

Sugar from La Laguna, Pampanga, Cebu, Batangas and Occidental Negros illustrating the different grades and methods of packing were shown. Canes from La Laguna, Pampanga and a collection of 6 varieties from the La Carlota experiment station were exhibited, together with a map, tables of statistics, and photographs.

In the section adjoining the fruit, M. & R. Hermann exhibited apparatus for destroying termites. A termite colony was shown, with the queen, and information concerning eradication was given.

SEEDS.

In the last section on the right, methods illustrating the packing and testing of seeds and an experiment in soils showing drainage and types of soils were shown. Garden and flower seeds were also distributed free in this section.

Demonstrations in budding and grafting were given in the last section on the left. Instruments necessary in horticultural operations were exhibited and specimens of budded citrus were displayed. From 4 o'clock until 9 every afternoon and evening during the Exposition, lectures were given on methods of propagating.

The agricultural-horticultural exhibit won the first prize for Insular exhibits, a silver cup.

STEAM COPRA DRIER OF THE BUREAU OF AGRICULTURE.

By H. T. Edwards, *Assistant to the Director of Agriculture.*

With a loss of several million pesos annually, by reason of the crude and unsatisfactory methods used for drying copra in these Islands, the introduction and use of an improved copra drier becomes a question of great economic importance. The original plans for an apparatus to use steam heat were furnished about one year ago by Mr. O. W. Barrett, chief of the division of ex-

periment stations, but the details of construction have been worked out by Mr. Z. K. Miller, machinery expert of the Bureau. Unfortunately Mr. Miller did not have time to make any preliminary tests of the drier at the Pandacan repair shops of the Bureau, but it was decided to exhibit the original apparatus at the Exposition and to try it out there on the grounds instead of delaying its introduction to the public any longer. It is believed to be the first machine of this type. When perfected it may meet the requirements of the Philippine copra industry and thus help to raise the standard of that product in the Orient.

This drier is 5.64 meters long by 91 centimeters wide, 3 meters high at the front and 2.44 meters high at the rear end. Its sides are constructed of angle iron frames for the sections into which are riveted two sheets of plain galvanized iron with 3-millimeter asbestos millboard between. The tracks for the trays are set on an incline of 61 centimeters to 46 centimeters. There are three rows of these trays with a 51-centimeter space between the rows. Each row holds four trays or a total of twelve trays for the drier. The trays, which are 91 centimeters by 1.37 meters, and 1 decimeter deep, are constructed of wire and angle iron with the bottoms made of bamboo slats set 6 millimeters apart. Each tray has a capacity of about 160 nuts. The trays are fitted with trunk rollers and can be easily handled by two laborers. The incline is such that very little effort is required to push the trays when loaded. Each track has an entrance door and a discharge door 91 by 28 centimeters. There are also three doors of the same dimensions on the top of the drier to carry off the moisture while fresh air is admitted at the bottom below the coils. The coils, located at the bottom of the drier, contain 1,219.20 square meters of heating surface, which will maintain an even temperature between 150° and 180° and will dry the copra in fifteen hours.

There are three methods of handling the raw material in connection with this type of drying apparatus:

1. The Birchfield method which obviates the necessity of husking the nuts—that is, the entire nut is chopped in halves by means of a heavy broadax, the halves being immediately placed either in the sun on a concrete or hard earth *patio*, or placed directly in the trays of the drier where after two or three hours the meat may be readily removed and then replaced to complete the drying process, the refuse husk and shell being thrown aside for fuel.

2. The husked nuts are broken in halves and the shells are either set out to dry in the sun so that the meat can be removed

after about one day of good weather, or else put directly into the trays of the drier and treated as by the first method.

3. The meat from whatever process at any stage of dryness is put into the trays without considering the previous operations and kept there until the attendant in charge pronounces the drying complete. With the latter method of procedure the capacity of a drier of this size is estimated to be about 3,000 nuts in twenty-four hours.

It must be remembered that unripe or partially decayed nuts can not be expected to make first-class white copra, though there is a better chance of obtaining a fair article by the use of this type of drier than by the prevalent "tapáhan" method; the faults which are partially concealed by the tapáhan method—that is, by the smoke obscuring the natural color of the material—are brought out clearly in operating artificial driers. Pinkish or brownish pieces of copra can be readily traced to either one or the other of the errors which are so deplorably common in Philippine copra making; that is, *unripe*, or *overripe* kernels.

The principal advantage in the use of the steam drier is that it is practically impossible to burn the material during the drying though, of course, the time required for turning out a copra which will endure storage in the bodega for several months is considerably longer in the case of an apparatus like this than with a hot-air, or rotary oven, type—makers of some machines of the latter type claiming to be able to turn out thoroughly dried copra in "two to three hours."

Either husks, shells (or in the case of the Birchfield method, the two materials attached), wood, or coal, can be used for fuel. Only the simplest type of boiler is required for furnishing steam; of course, a comparatively large grate is necessary if the husks are used; and in case the shells alone are burned, care must be taken to protect the sides of the furnace from the intense heat by means of sheet iron or similar material. The water condensing from the pipes in the drier returns, of course, to a tank or reservoir from which water is injected back into the boiler as often as required. Thus there is practically no expense for either fuel or water in operating a drier of this type.

The present drier cost about ₱600. A drier constructed along similar lines with reinforced concrete walls, boiler, and accessories complete, having a capacity of about 15,000 nuts per twenty-four hours, can be constructed for approximately ₱2,500.

The drier exhibited at the Exposition grounds was set up there before it had been tested or even assembled at the factory. Considering this fact the results obtained were exceptionally

good. A number of prominent copra dealers and owners of coconut plantations examined the drier in operation and were enthusiastic over the quality of the finished product. Several of these people wanted to buy the drier, stating that they were well satisfied with the results.

This drier will be taken to the Pandacan repair shops of the Bureau of Agriculture where exhaustive tests and experiments with it will be carried on for several months until accurate information has been obtained as to the most economical method of drying copra. The information thus obtained will then be published.

LIVE-STOCK SHOW, FIRST PHILIPPINE EXPOSITION.

By C. W. Edwards, *Agricultural Inspector.*

When we compare typical specimens of our present-day breeds of domestic animals with their progenitors or the foundation stock which was combined to produce them, it seems almost incredible that such results could have been attained mainly through the agencies of proper care, selection, and breeding—keeping in mind, of course, the ever-present influence of environment. Before the process of development could advance materially toward systematic improvement, however, it was necessary that certain standards be established toward which endeavor could be directed. One of the most potent factors instrumental in creating these standards was the live-stock show; this offered a means of assembling individual fragmentary ideas into a more or less definite or concrete form, resulting in the directing of community efforts toward the same end, following as the greatest good the raising of the general average of excellence of the animals of an entire section or country.

The shows of the Occident have now passed the formative period and their mission consists not so much in aiding the creation of new breeds, as in the further improvement of those already established; here, however, we are confronted with conditions and problems characteristic of no other country, and effort must be directed accordingly. Industrial expositions are still in the exploitational stage, and the work of the live-stock show at present lies not so much in striving toward the further development of the well-established breeds, but rather in providing an opportunity for the study of these with respect to their adaptability to our peculiar conditions, and their comparative value as a cross when used upon the various indigenous types in the great work of up-grading the latter.

That there is a crying need for improvement in the animal-husbandry conditions of the country is evident by the great dearth of dairy, work, and beef animals, and the fact that the inferior native types are the certain results of wholly natural

generation—scarcely no attention having been given to breeding and selection. As one of the means toward remedying these conditions, the live-stock show was instituted three years ago and held in connection with the 1910 Carnival. Naturally, the obstacles to be overcome in this work are manifold, but in spite of these, if the large increase in number and quality of entries at this year's exhibit—as compared with those of the two former years—and the apparently sincere interest of the thousands of visitors is any criterion, very encouraging progress has been made. This increase in the number of entries is more significantly indicative of a growing public interest when we consider that many of the presentations came from the provinces.

Only enthusiastic compliment can be bestowed upon the showing made by the eighty-odd horses composing the twenty interesting classes. American and Australian pure breeds, native and Chinese types and crosses (mestizos) vied for ribbons which were very ably and impartially placed by Dr. J. A. McKinnon, W. H. Fell,[1] and José Gavito. The classes best and most creditably represented were those including the many native ponies and crosses (mestizos); a majority of the latter were sired by the Bureau stallions "Handrail" and "Chester, Jr.," the presenting of which should do a great deal toward removing the skeptical objection many Filipinos have to breeding their mares to pure-bred stallions. A feature of special mention was the Batangas collection of select ponies and grades, and the eight blue ribbons won by them furnish concrete evidence substantiating Batangas' claim as the producer of the best horses in the Philippine Islands. For this showing, the province was presented with a diploma for the best collective exhibit. The Bureau of Agriculture's entries included choice specimens of Arabians, Thoroughbreds, native ponies, and grades, the latter the get of Arabian and American sires from native dams and of native sires from American dams. The subprovince of Catanduanes sent a number of range horses which attracted considerable attention as examples indicating what can be accomplished by utilizing natural pastures exclusively. The animals found a ready sale during the exposition. The fact that this distant island participated in the show is most encouraging in that it indicates that the people of this district are giving attention to their live-stock interests. Catanduanes has nearly 4,000 horses and, according to the best of information, has always been free from serious equine diseases; nevertheless, owing to the fact that

[1] For the classes in which W. H. Fell had entries, E. J. Koert substituted as judge.

little if any attention has been paid to improvement, their animals are, for the most part, small and rough in conformation. The Bureau of Agriculture now has eight stallions in the island and the people are according hearty support to the work of upgrading their ponies.

Dairy and beef breeds, imported work bullocks, native types, and various crosses, composed the bulk of the cattle section. The exhibits of Jacinto Limjap and Alberto Sisi, made up of Shorthorns (milking strain) and Ayrshires, contained some very good illustrations of the bovine qualities sought in the dairy animal. Among the work animals were Indo-Chinese, a number from the Island of Formosa, Dalupiri bulls from the island of that name situated north of Luzon, and native types from the Province of Cagayan. The Formosa cattle, large importations of which have only recently been made, are apparently of Chinese origin, are smaller in stature than the Indo-Chinese, though more compact, and should make very good work animals. Eugenio Evangelista was the largest exhibitor in this class. The Bureau of Agriculture presented some superior specimens of Nellores and Herefords together with native and Chinese cows having grade calves at side, sired by bulls of the aforementioned and Galloway breeds. Of these, the Hereford grades elicited very favorable comment. The white faces have been most instrumental in improving the scrub ranger of America, and being animals of good rustling qualities, they are worthy of further experimentation in this country. Plans are now under way for the importation of more of these cattle. The winners in this division were chosen by W. N. Birch and E. S. Haskell.

The carabao division was represented by Indo-Chinese, native, and Indian types; this class presented a number of individuals of superior size and conformation. Faustino Lichauco led with the number of entries in the Indo-Chinese section and Mariano Molo exhibited the Indians. The latter is principally a dairy breed but also serves very well when used for draft purposes. It would seem that in this country, where there is a great scarcity of dairy stock, that there is a place for this class of animals. In certain sections the carabao is being replaced by the bullock, but there are immense areas devoted to rice growing where carabaos are, under present conditions, indispensable. The eager attention received and satisfactory sales made in this division were indications that to date, they still remain the most important work animals of the Philippine Islands.

From first to last, keen interest centered about the excellent display of porcine merits exhibited by the Berkshire and Chester-White pure breeds and the half and three-quarter grades. At present swine raising and improvement is receiving a great deal of attention and all animals offered for sale were readily disposed of at fancy prices and many times the number could have been sold. The Berkshires were easy winners with respect to numbers and quality of individual entries. Owing to their prolificacy and prepotency, the introduction of this breed is proving a boon to swine husbandry in this country and the grades were valuable object lessons demonstrating the Berkshire's sterling merit as a cross for the inferior native "razor backs." The largest class in the division was the "foreign breeds, native-bred," with E. Wickham offering the greatest number of entries. The Bureau of Agriculture showed some excellent imported sows and boars from the breeding herd at the Alabang stock farm. The placings in this department were made by J. L. Fattey.

The poultry section, filled with many exceptionally fine birds representing twenty different breeds and varieties, was exceedingly popular with the many visitors. Leghorns, Cochins, Orpingtons, Plymouth Rocks, and Langshans made up the largest portion of the display and numbered many of the choicest fowls presented. Manuel Sequera, A. L. Barden, and Mrs. A. J. Neal were the largest exhibitors. An encouraging feature of the exhibition was the entries from the Manila schools. Honorio Lasám presented a unique entry of wild chickens, and crosses of same with native fowls, from the Cagayan Province. The large demand for fresh poultry products and breeding stock in Manila and the larger provincial towns offers a tempting inducement for one to engage in the business commercially. However, the greatest benefit resulting is the dissemination of knowledge among the masses of the Filipino people, placing them in a position to produce more food for their own consumption. Already the observer will note in many a farmer's yard a prevalence of mestizo fowls, concrete examples of the good already accomplished by the pioneer importers and breeders. Capt. George Seaver and Carl F. Preusser acted as judges in this division.

The judging of all classes took place February 9, and the winners of first and second places were awarded ribbons and diplomas.

A list of prize winners and their respective addresses follows:

HORSES.

Imported coach breeds:
- First .... Lieutenant Miller, Fort McKinley.
- Second .... W. H. Fell, American Livery Stable, Escolta, Manila.

Imported light-harness breeds:
- Stallions—
  - First .... Dr. Roberto Chuidian, Manila.
  - Second........ José Oliver, 90 Carriedo, Quiapo.
- Mares—
  - First .... Chas. H. W. Aitken, El Varadero, Cavite.
  - Second........ Messrs. Roseburg & Berger, 149 Rotonda, Sampaloc.
- Geldings—
  - First .... W. H. Fell, American Livery Stable, Escolta, Manila.
  - Second........ Messrs. Roseburg & Berger, 149 Rotonda, Sampaloc.

Imported brood mares:
- First .... J. Giloy, 421 Rotonda, Sampaloc.
- Second........ C. D. Squires, 100 Santa Clara.

Imported horses under 14 hands:
- First .... W. H. Fell, American Livery Stable, Escolta.
- Second........ W. H. Fell.

Cochin China pony class:
- Mares—
  - First .... J. Giloy, 421 Rotonda, Sampaloc.
  - Second........ C. W. Hubbell, 22 Sandejas, Malate.
- Geldings—
  - First .... Faustino Lichauco, 33 Plaza Cervantes.
  - Second........ J. Giloy, 421 Rotonda, Sampaloc.

Foreign breeds, native-bred:
- Stallions—
  - First .... Chas. H. W. Aitken, El Varadero, Cavite.
  - Second........ San Nicolás Fire Station, Manila.
- Mares—
  - First .... San Nicolás Fire Station, Manila.

Foreign-native cross:
- Stallions over 48 months—
  - First .... Mauro Prieto, 964 San Sebastian, Manila.
  - Second........ Gregorio Agoncillo, Lipa, Batangas.
- Stallions under 48 months—
  - First .... Mariano Katigbac, Lipa, Batangas.
  - Second........ Leopoldo Almeda, Tanauan, Batangas.
- Stallions under 36 months—
  - First .... Proceso Mayo, Lipa, Batangas.
  - Second........ Vicente Luntoc, Taal, Batangas.
- Mares over 48 months—
  - First .... R. B. Genato, 852 San Sebastian.
  - Second........ Faustino Lichauco, 33 Plaza Cervantes.
- Mares not over 48 months—
  - First .... Major Jones, Bureau of Constabulary, Manila.
  - Second........ Cipriano Lopez, Balayan, Batangas.

Native:
- Stallions over 48 months—
  - First .... S. M. Berger, 255 Alix, Sampaloc.
  - Second........................ Santos Sarmiento, Lipa, Batangas.
- Stallions not over 48 months—
  - First .... Miguel Lozano, Lipa, Batangas.
  - Second........................ Victor Templo, Lipa, Batangas.
- Mares—
  - First .... Thos. L. Finnerty, 551 Cervantes, Santa Cruz.
  - Second........................ E. H. Koert, Virac, Catanduanes.

Native range ponies:
- Stallions—
  - First .... Cecilio Arcillo, Virac, Catanduanes.
  - Second........................ Valentin Francisco, Virac, Catanduanes.
- Geldings—
  - First .... Valentin Francisco.
  - Second........................ Valentin Francisco.

CATTLE.

Imported dairy breeds:
- Bull—
  - First .... Jacinto Limjap, 48 Estero Cegado, Santa Cruz, Manila.
- Female over 2 years—
  - First .... Jacinto Limjap.
  - Second........................ Jacinto Limjap.

Imported draft breeds, Chinese or Indo-Chinese:
- Bull over 2 years—
  - First .... Eugenio Evangelista, 112 Clavel, Binondo.
  - Second........................ Faustino Lichauco, 33 Plaza Cervantes.
- Female over 2 years—
  - First .... Eugenio Evangelista, 112 Clavel, Binondo.
  - Second........................ Eugenio Evangelista.

Foreign breeds, native-bred:
- Bull over 2 years—
  - First .... E. G. Limjap, 48 Estero Cegado, Santa Cruz.
  - Second........................ Alberto Sisi, 663 Alix, Sampaloc.
- Female over 2 years—
  - First .... Alberto Sisi.
  - Second........................ E. G. Limjap.
- Female under 2 years—
  - First .... E. G. Limjap.
  - Second........................ Alberto Sisi.

Foreign-native cross: Bull over 2 years—
- First .... Government of Isabela.

Native breeds:
- Bull over 2 years—
  - First .... José Aldecoa, 9 Plaza Moraga, Binondo.
  - Second........................ José Aldecoa.
- Bull not over 2 years—
  - First .... Pastor Macanaya, Tuguegarao, Cagayan.
  - Second........................ Pastor Macanaya.
- Female over 2 years—
  - First .... E. G. Limjap, 48 Estero Cegado, Santa Cruz.

CARABAOS.

Imported draft breeds:
- Bulls over 2 years—
  - First .... Faustino Lichauco, 33 Plaza Cervantes.
  - Second........................ Faustino Lichauco.
- Castrated males any age—
  - First .... Faustino Lichauco.
  - Second........................ Faustino Lichauco.

Native draft breeds:
- Bulls not over 3 years—
  - First .... Pastor Macanaya, Tuguegarao, Cagayan.
- Females not over 3 years—
  - First .... Pastor Macanaya.
  - Second........................ Mariano Molo, Pasay, Rizal.

Dairy breeds, imported or native:
- Bulls over 3 years—
  - First .... Mariano Molo, Pasay, Rizal.
- Females over 3 years—
  - First .... Mariano Molo.
  - Second........................ Mariano Molo.
- Females not over 3 years—
  - First .... Mariano Molo.
  - Second........................ Mariano Molo.

SWINE.

Imported: Female over 1 year—
- First .... J. R. Keykendell, 249 San Andres, Malate.

Foreign breeds, native-bred:
- Male over 1 year—
  - First .... J. R. Keykendell.
  - Second........................ E. Wickham, 465 Santa Mesa.
- Male not over 1 year—
  - First .... E. Wickham.
- Female over 1 year—
  - First .... E. Wickham.
  - Second........................ E. Wickham.
- Female not over 1 year—
  - First .... E. Wickham.
  - Second........................ E. Wickham.

Foreign-native cross:
- Female over 1 year—
  - First .... E. L. Worcester, Cabanatuan, Nueva Ecija.
- Female not over 1 year—
  - First .... Wm. Wolfert, Tondo Fire Station.
  - Second........................ J. R. Keykendell, 249 San Andres, Malate.
- Female and litter—
  - First .... A. J. Gibson, 522 Nueva, Ermita.
  - Second........................ J. R. Keykendell, 249 San Andres, Malate.

Native:
- Male not over 1 year—
  - First .... B. Fernandez, 881 Isaac Peral, Ermita.
- Female not over 1 year—
  - First .... B. Fernandez.

SHEEP AND GOATS.

Southdown buck:
  First .... E. L. Worcester, Cabanatuan, Nueva Ecija.
Native goat:
  First .... José Xeres Burgos, 167 Lamayan, Santa Ana.

POULTRY.

Light Brahmas: Trio—
  First .... Manuel Sequera, 30 Alix, Sampaloc.
  Second .... Manuel Sequera.
Barred Plymouth Rocks:
  Cock—
    First .... A. J. Neal, 1542 Real, Malate.
    Second .... A. L. Barden, 99 Dominga, Pasay.
  Cockerel—
    First .... Maxima Sakay, Manila.
    Second .... Maxima Sakay.
  Hen—
    First .... A. J. Neal, 1542 Real, Malate.
    Second .... A. L. Barden, 99 Dominga, Pasay.
  Pullet—
    First .... A. J. Neal.
    Second .... A. J. Neal.
  Trio—
    First .... Thos. L. Finnerty, 551 Cervantes.
    Second .... A. L. Barden, 99 Dominga, Pasay.
Black Orpingtons:
  Cock—
    First .... Pandacan School.
  Hen—
    First .... Pandacan School.
Black Langshans:
  Cock—
    First .... Pandacan School.
  Cockerel—
    First .... José Xeres Burgos, 167 Lamayan, Santa Ana.
  Hen—
    First .... Pandacan School.
    Second .... Pandacan School.
Native: Trio—
  First .... Capt. Wm. Wolfert, Tondo Fire Station.
Pit Game:
  Cock—
    First .... Honorio Lasám, Tuguegarao, Cagayan.
    Second .... Bernabe Aquino, Tuguegarao, Cagayan.
  Hen—
    First .... Honorio Lasám.
    Second .... Honorio Lasám.
Indian game: Trio—
  First .... A. J. Neal, 1542 Real, Malate.

American White Leghorns:
- Cock—
  - First .... A. L. Barden, 99 Dominga, Pasay.
- Cockerel—
  - First .... A. J. Neal, 1542 Real, Malate.
  - Second........ A. L. Barden.
- Hen—
  - First .... A. L. Barden.
- Best display—
  - First .... A. J. Neal.
  - Second........ A. L. Barden.

Australian White Leghorns:
- Cock—
  - First .... Pandacan School.
  - Second........ Pandacan School.
- Cockerel—
  - First .... Pandacan School.
  - Second........ Pandacan School.
- Hen—
  - First .... Pandacan School.
- Best display—
  - First .... Pandacan School.

Rhode Island Reds: Trio—
- First .... A. J. Neal, 1542 Real, Malate.

Haudans: Trio—
- First .... Manuel Sequera, 30 Alix.

Mixed foreign breed: Trio—
- First .... Manuel Sequera.

Foreign breeds:
- Chinese chickens—
  - First .... E. F. Cheney, 1127 Leveriza, Malate.
  - Second........ E. F. Cheney.
- Java game cock—
  - First .... E. F. Cheney.

Buff Orpington: Trio—
- First .... Pandacan School.
- Second........ Manuel Sequera, 30 Alix.

Silkies:
- Cock—
  - First .... A. J. Neal, 1542 Real, Malate.
- Hen—
  - First .... A. J. Neal.

Wild chickens:
- Cock—
  - First .... Honorio Lasám, Tuguegarao, Cagayan.
- Hen—
  - First .... Honorio Lasám.

Ducks:
- First .... B. Fernandez, 881 Isaac Peral, Ermita.

THE PROVINCIAL EXHIBITS, FIRST PHILIPPINE EXPOSITION.

By O. W. Barrett,

Chief, Division of Experiment Stations, Bureau of Agriculture.

There is no question but that agricultural materials in the First Philippine Exposition comprised by far the larger portion of the exhibits from the various Insular provinces, and this means that not only do the authorities and exhibitors fully realize the preponderance of agriculture over all other lines of development in the Islands, but it also shows that there is but little with which to make a really first-class display outside of the products of the soil.

Generally speaking, the arrangement of these exhibits was good and in several instances the logical grouping and the decorative art ideas in evidence were excellent. If any adverse criticism could be made on the displays, as a whole, it could be, perhaps, the common fault of inadequate labeling; this to the ordinary exhibitor is an insufficiently appreciated subject, since he can not regard the materials from the point of view of the casual observer; however, he frequently can not obtain at short notice, during the unpacking and arranging of exhibition objects, such labels and placards as are almost necessary for the due understanding of the individual exhibits.

The provinces were apportioned sections in four large buildings arranged on either side of "Prosperity Row," extending from the Bureau of Education Building on the west to Machinery Hall at the east end of the grounds. These booths varied in size from two to four units, each unit being 5 meters in frontage; the depth of each allotted space was 18 meters. The lighting, both during the daytime and night, was more than was to be expected, though on the rainy days at the beginning of the Exposition the public had some difficulty in examining the materials in the inner portions of the booths.

Since the exhibits from no two provinces were at all alike

it may be of interest to mention the principal agricultural features shown in each provincial section:

La Union.—This province rivaled Ilocos Sur and Ilocos Norte in the display of native cotton fabrics; the exhibit of blankets, towels, etc., woven from homegrown cotton, was especially interesting, and the native hand-loom illustrating the method of weaving these cloths was an added attraction.

A collection of fish nets and baskets decorated a portion of the wall.

A fair lot of vegetables and a good collection of rice "heads," maize, copra, and tobacco was in evidence.

The basket and shell work made at and displayed by the industrial schools of the province compared favorably, though not in so great a variety of designs, with the other provinces.

The white "tugue," or yam, was featured as one of the decorative materials of a special booth; this is believed to be the whitest and best yam of its size in the world.

Ilocos Sur.—Splendid specimens of the famous Ilocano towels, table covers, and coarse cotton goods were in evidence, and looms for weaving same were in operation. Beautiful specimens of embroidery were also shown. Samples of maguey fiber were, of course, exhibited, since this province excels all others as a producer thereof.

Harness, saddles, and general leather work were shown to good advantage.

A good display of unfinished hand-made chairs, furniture, boxes, etc., was shown. Matting, in fair variety of design, decorated the walls.

The famous Abra tobacco, from the subprovince of that name, was also shown here.

Presumably on account of the bad season the farm products, especially maize, were not in first-class condition. The coconuts were above the average in size.

Specimens of silver work, such as cane-heads, spoons, etc., of exquisite Ilocano designs, attracted considerable attention.

Capiz.—A fine display of palm-fiber fabrics made an imposing display in this section. Fine specimens of buri cloth, both uncolored and dyed, decorated the walls. Matting, of both buri and nipa, and basketwork, ropes, hats, etc., made from cabo negro and buri, were in evidence.

Excellent samples of piña cloth, together with a Visayan loom for making the same, drew much attention. Beautiful samples of abacá were shown, though this province makes no great claims in the production of that crop.

Samples of fully 200 varieties of rice, attractively displayed both as bundles of baled heads and in baskets of shelled grain, were in evidence.

Other objects of special interest were: Beautiful specimens of shell-flower work; artificial wreaths; a hat made from the fiber of one "dish-cloth" gourd, or luffa; specimens of cloth woven from the famous Capiz cotton; beautiful jusi and piña embroidered; also a fine embroidered fan made of piña; samples of lignite, and kaolin, or "yeso."

Bulacan.—Colored mattings covered the walls of this very artistically arranged exhibit and a fine collection of jusi fabrics was featured, together with the jusi loom of the province.

Fine specimens of pandang chairs, guano samples, bricks, building stone, and a model iron forge representing the native method which has been used for many years in the province, were shown.

Among the horticultural materials a display of excellent carabao mangos, several varieties of bananas, rootcrops, and a fine watermelon were shown, also a good collection of rice.

A great variety of mats, hats, and basketwork adorned the walls and specimens of rattan hats, worth up to ₱100, as well as cheaper samples made of buri and bamboo, were also shown.

Occidental Negros.—As would be expected, the first object to strike the visitor's eye on entering this section was an exhibit of sugar; Señor Esteban de la Rama, from Talisay, Bacolod, exhibited samples of genuine centrifugal sugar, a heretofore almost unknown substance in the Philippines.

Beautiful specimens of abacá, both in the rough and made up, adorned the walls and pillars of the section; huge specimens of the stems, one about 6 meters in height, surrounded the central booth.

A unique center cabinet, made in mosaic from cabo-negro chips and strips, formed a beautiful exhibit; and two lions carved from single blocks of molave wood guarded the entrance of the section.

A gigantic honeycomb hung in the rear of the section and a specimen of extracted wild honey was near by.

Fine specimens of piña cloth and a collection of shells filled the central cabinet. Some 387 varieties of rice were arranged in the rear of the booth.

Fine bundles of bejuco, both in coils of unfinished stems and as manufactured articles, were in evidence. Samples of cordage and ropes, made from cabo negro and buri fibers were also shown.

A good collection of native rootcrops, timbers, and grains in

abundance were displayed; also tobacco, maize, and fine specimens of sun-dried copra.

Interesting samples of mineral products, such as coal, sulphur from Monbucal (near Canlaon), "yeso," and almáciga were in evidence.

Isabela.—This province made little effort to make a display of anything except its famous tobacco; this, however, was in striking variety, both as to raw product and manufactured article.

Three record-breaking bejucos, one 120, one 140, and one 160 meters in length, were shown.

A collection of baskets made from various materials and fine specimens of kaolin were seen.

Oriental Negros.—The exhibit of this province included the following noteworthy articles: A commercial bale of kapok ready for shipping to mattress and life-preserver manufacturers together with a quantity of the natural product in pods and partly ginned, from the plantation of Mr. Henry Fleisher at Dumaguete.

Cane, maize, tobacco, rice, and coconuts decorated the walls.

A collection of coconut pests, including a rare kind of beetle several times the size of the ordinary "uang," or rhinoceros beetle, were shown.

The Silliman Institute at Dumaguete exhibited a wonderful display of furniture and bric-a-brac made from the famous camagon; among these was a desk of which any cabinetmaker in any country in the world could well be proud, the contrasting black and smoky-brown markings of the wood "holding the eye" of the observer.

Cebu.—The large section occupied by the exhibits of this province contained materials enough for an entire day's careful study. A central pavilion covered with corn, corncobs, nipa fruits, coconuts, etc., was a striking feature; the arches were hung with portières composed of maize kernels and mungo seeds.

A large lot of samples of cotton, piña, and jusi cloths was shown.

Basketwork in great variety made of fibers and rattan was also in evidence.

There was a collection of rootcrops, among which was the largest yam shown at the Exposition. Specimens of maguey and sansevieria, as well as abacá, were in evidence. There was also a loom for weaving jusi and piña.

Misamis.—Among the numerous interesting specimens ex-

hibited by this province must be mentioned the guano from the vicinity of Cagayan (evidently from bat caves), "yeso," gutta-percha, resin (almáciga), beeswax, matting, and mineral water from the volcanic island of Camigin.

Live tortoise-shell turtles occupied a prominent place in a tank at the entrance while two snakes occupied a dark corner at the rear.

The walls were decorated with abacá, palm mats, etc.

Batangas.—The walls of the exhibit were covered with sugar cane, maize, mats, and cloths in great variety.

A special horticultural feature was, of course, the famous Batangas naranjita, or Mandarin orange. Due to the enthusiasm and good example of the agricultural schools in the province there was a display of hundreds of orange and cacao seedling trees in pots, excelling all other similar displays at the Exposition. Samples of cotton, both brown and white, were shown, and a large number of rice varieties, grains, etc., were in evidence.

As a sad reminder of the lost coffee industry in this province, a few samples of Liberian, instead of the good old Arabian coffee, were displayed.

The weaving of jusi was shown in a booth on the right while the center was occupied by a magnificent display of embroidered cloths.

Nueva Ecija.—Though occupying a comparatively small space, this province displayed some 256 varieties of rice, both in sacks and unthreshed heads, attractively placarded. The ceiling of the section was fancifully decorated with flower-like clusters of tobacco leaves and rice heads.

A pillar covered with wool formed a unique exhibit in the center of the section. As evidenced by specimens of various kinds of calesas, the wheelwright profession is a worthy one in this province. Blocks of wood from which these vehicles were made were also shown.

Shoes and chinelas, in great variety, together with mats, hats, towels, blankets, etc., decorated the walls while a cotton loom in operation attracted considerable attention.

Sugar occupied a small but rather important place in this province's products.

Iloilo.—As would be expected, the center of this large section was occupied with five looms for weaving piña and jusi cloths and the walls of the booths were decorated with beautiful specimens of the latter, flanked by cane, palay, tobacco, maize, and even, in one corner, a huge pile of unhusked coconuts.

To examine carefully the exhibit of jusi and piña cloths and embroideries would require at least one day for this province alone; it is undoubtedly the center of the industry for the whole Archipelago.

Hammocks and hats in process of making were shown.

Samples of building stones, limestone, and earthenware water filters were exhibited.

About 110 varieties of rices claimed attention and specimens of excellent sun-dried copra were seen.

On account of the drought the exhibit of rootcrops was deplorably small. Two types of the rare "ivory," or white coconut, were in evidence. Bamboo chairs and a full line of fishing apparatus claimed the sightseer's attention.

Tarlac.—In the center of this large section was shown a model rice plantation showing the standing crop, a stack of unthreshed grain, implements for handling the crop, and a model house of a rice-estate superintendent.

The walls were decorated with basketwork, matting, rice, cane, tobacco, and coconuts. Building materials and earthenware occupied a prominent place, especially the water coolers with spigots.

About 300 specimens of rice were shown, and sesamun, tobacco, coconuts and cane were in evidence.

La Laguna.—The entrance to this praiseworthy exhibit was fancifully decorated with ornamentals and a generous display of the ubiquitous coconut which has made this province so famous.

Among the coconut products exhibited were alcohol, running from 40° to 80° pure, vinegar, sugar, and oil—one specimen of the latter being nearly white. A striking feature was the giant pandanus which is practically confined to this province (one plant having leaves fully 4 meters in length); one of the fruits of this pandang, as large as an ordinary jakfruit, was in evidence.

Some eight presumably distinct varieties of bejuco, or rattan, formed an interesting exhibit in the rear of the section.

The famous Santa Cruz glazed earthenware, in great variety of style, was in evidence.

A fine collection of fruits, vegetables, and rootcrops attracted considerable interest. Hats, mats, and articles for house decoration were displayed.

The famous Isuan and Makiling bottled waters were, of course, a prominent feature of the exhibit.

Tayabas.—This province closely rivaled La Laguna in the

matter of coconuts and copra exhibits. Near one entrance were seen the rare guimaring, or "ivory" coconut, a huge giant variety (one nut measuring 85 centimeters in circumference), also a red nut, and several dwarf types. This province may well be proud of its coconut crop since it already produces about 18 per cent of the copra of the Philippines from more than 6,000,000 trees, the annual export value being about ₱5,000,000.

Samples of La Nita coconut alcohol, made in Tayabas, were shown, together with coconut oil and a collection of tools for gathering and handling the nuts.

Looms for weaving sinamay, or abacá cloth, were shown in operation, and splendid samples from Marinduque Island attracted much attention.

The exhibit of pili nuts together with a quantity of pili resin, or "gum elemi" (white dammar) was in evidence. Lumbang nuts were also shown. The walls were decorated with abacá and matting samples.

The Mainit mineral water was here in evidence.

The largest block of coal ever mined in the Philippines and a unique exhibit of petroleum from Mulanay on the Bundog Peninsula were shown. A large number of commercial timber samples were also exhibited.

Mindoro.—The rear portion of the section allotted to this province was arranged as a miniature mountain, the slopes of which were covered with orchids, ferns, and aroids; parrots, deer, and the wild jungle fowl, ancestor of our domestic poultry, drew great attention. At the entrance to the exhibit was a fine mounted specimen of the famous timarau, which is perhaps the rarest large mammal in the world. A pillar at the entrance of the section was covered with a fine collection of sponges, which appear to be confined largely to this province, as a commercial enterprise, at least. A giant sugar cane 7.9 meters (over 26 feet) in length was shown. A wooden tray made of one narra block, 1.58 meters (5 feet 3 inches) in diameter, was shown.

The longest single piece of rattan at the Exposition was found here, it measured not less than 192 meters (624 feet) in length.

Abacá from Calapan was also shown, and a collection of minerals and kaolin was in evidence. Dried yam chips together with wild roots from which this "condensed-ration" food product is made were shown.

A huge block of honeycomb from the vast forests of this soon-to-be famous island was in evidence.

Bohol.—Among the principal exhibits of this province were the specimens of copra which easily exceled all other samples

shown, as well as seed coconuts (also of the best), yams, sugar, maize, mats, abacá, and rice. Three features of the exhibit were especially worthy of attention, namely: The two types of guano, one from bat caves and the other a phosphate guano; a cage containing living colugos, or flying lemurs, was to be seen at one of the entrances; a fine collection of skins of this exceedingly rare animal decorated the walls.

Samples of banana (sabá) cloth, as well as sinamay and cotton, were well worthy of study.

Antique.—The principal exhibits of this province consisted of fiber cloths, rice, in good variety, cane, and various forms of sugar. Coal and splendid almáciga (semifossil resin) were also shown.

Leyte.—A fine collection of rice varieties occupied a prominent place in the exhibit of this province and the walls were fancifully decorated with mats and various native cloths. Abacá was a prominent feature and looms for weaving native cloths were displayed. A collection of rootcrops also drew considerable attention.

Ambos Camarines.—A cabinet containing a large set of samples from the famous Paracale gold mines occupied a prominent place in this section.

Coconuts were by no means an insignificant factor, and abacá was everywhere, of course.

Samar.—A great feature was made of the display of rattan, vegetable fibers, and woods; coal was also shown, and the rootcrops, grains, etc., compared favorably with those of more highly developed provinces.

Mountain Province.—By far the most striking feature of the kind in the whole Exposition was the native iron-working apparatus; both Kalinga and Igorot methods were in operation. Native Kalinga looms made with no wooden framework were shown in operation. Specimens of the native cloths and weapons were used to cover the walls of the exhibit.

Moro.—The prime feature of this exhibit was the Pará and Ceará rubber samples from Basilan Island; this rubber, which it appears has held its own with the cultivated rubber of Malaya, was well worthy of study, although the arrangement of the exhibit was perhaps not above criticism.

Coffee, gutta-percha, maize (a first-class cross of Mexican June and a native flint corn), tobacco, abacá, cacao, and coconuts were in evidence.

Mats and a fine collection of Moro brasses, weapons, cloths, and beadwork formed a striking feature of the exhibit.

Pangasinan.—The ceiling of this section was artistically made by suspending heads of rice, while the center was occupied with a huge mountain of the same material. The walls were decorated with coconuts, cane, and rice. Though the variety of materials left something to be desired, the arrangement of the display was certainly one of the most artistic of the Exposition.

Ilocos Norte.—The comparatively small space allotted to this province was well filled with looms for the native cotton cloths, rattan specimens, tobacco, and kapok.

The Batak School farm's fine exhibit of fruits and vegetables was displayed in the Bureau of Education Building.

Albay.—The ceiling of this section was made of abacá draped into huge waves and festoons, this province having long been famous for that fiber. Three types of abacá-stripping machines were in evidence and from time to time were put in operation for the benefit of the public. The Island of Catanduanes also exhibited interesting specimens of rice and roots of the largest cultivated aroid (*Cyrtosperma merkusii*). Fine specimens of buri were in evidence as also looms for weaving native cloths. Copra, cacao, grains, etc., claimed attention, while great masses of orchids and ferns hung from the ceiling.

Cagayan.—The rather limited space for this province was well filled with a miniature field of tobacco plants, showing the method of cultivation, while the walls were decorated with basketwork, native weapons, tobacco, etc. Fine samples of almáciga were shown.

Cavite.—The ceiling of this section was roofed in with the window shell which is one of the principal products of the province. The collection of vegetables, fruits, and grains was above the ordinary; several varieties of bananas were of interest and are probably more or less confined to the province. A loom in operation occupied a prominent place, and sinamay cloths, abacá, sugar, and basketwork held the sightseer's eye.

Pampanga.—The background of this section was arranged in a very striking way as a country scene with fields of the different crops, mountains, terraces, etc., in view. The collection of vegetables and fruits was perhaps the best of all the provincial exhibits. Various types of matting decorated the ceiling and walls and fruiting nipa palms adorned the entrance.

Nueva Vizcaya.—Due presumably to the drought the agricultural products, with the exception of rice, cane, and tobacco, did not occupy a prominent place in this section. Blankets and other specimens of native cloth and matting work were shown.

AGRICULTURAL-HORTICULTURAL AWARDS[1] AT THE FIRST PHILIPPINE EXPOSITION.

Committee on Awards.

F. W. TAYLOR, Chairman.
E. B. COPELAND.
H. T. EDWARDS.
F. W. SHERFESEE.

COCONUTS.

Best five seed-nuts:
- First .... Catalino Casinas, Bohol.
- Second........ José Nugarin, Cebu.
- Honorable mention .... Antonio Miñosa, Cebu.

Most copra from one nut:
- First .... M. Literal, Oriental Negros.
- Second........ Catalino Casinas, Bohol.
- Honorable mention .... E. S. Gotaner, Nueva Ecija.

Best picul of copra:
- First .... Catalino Casinas, Bohol.
- Second........ E. Matias, Albay.
- Honorable mention .... P. O. Mirjan, Tayabas.

Copra richest in oil:
- First .... Henry Fleisher, Oriental Negros.

Best sample of oil:
- First .... E. F. Malvar, La Laguna.
- Second........ E. S. Gotaner, Nueva Ecija.

Best sample of coconut fiber:
- First .... Eladio Sablan, College of Agriculture.
- Honorable mention .... Zacarias Albay, Capiz.

ABACA.

Longest fiber:
- First .... Ohta Development Co., Davao.
- Second........ Vicente Sanchez, Mindoro.

Strongest fiber:
- First .... Pardo Barrios, Ambos Camarines.
- Second........ Gerardo Quibo, Oriental Negros.
- Honorable mention .... Wilson Plantation Co., Davao.

Finest fiber:
- First .... S. A. Coronel, Cavite.
- Second........ Fausto Anciro, Cavite.
- Honorable mention .... Juan Araneta, Occidental Negros.

[1] These awards were based on exhibits made in the Provincial and Agricultural-Horticultural Buildings.

Best fiber:
- First .... Felipe de Morente, Mindoro.
- Second .... Wilson Plantation Co., Davao.
- Honorable mention .... Ohta Development Co., Davao.

Best hat-making fiber:
- First .... Aldamio Sobrino, Mindoro.

MAGUEY.

Best sample of maguey:
- First .... Maximo Alfafara, Cebu.
- Second .... Gregorio Florida, Cebu.
- Honorable mention .... Leona Inocelda, Ilocos Sur.

PINEAPPLE FIBER.

Best sample of pineapple fiber:
- First .... Florencio Bagui, College of Agriculture.

TOBACCO.

Best wrapper leaf:
- First .... Julian Sanson, Isabela.
- Second .... Mrs. Venancia Periera, Isabela.

Best plug-tobacco leaf:
- First .... Felix Paggao, Isabela.
- Second .... Joaquin Ortega, Ilocos Sur.

Best cured tobacco:
- First .... Mrs. Venancia Periera, Isabela.
- Second .... Angel Garces, Cagayan.

Largest sound tobacco leaves:
- First .... Ruperto Amadora,Cebu.
- Second .... Pedro Sanson, Isabela.

SUGAR.

Best exhibit of five stalks:
- First .... Hacienda Tinang, Tarlac.
- Second .... Sebastian Visitación, Oriental Negros.

Heaviest cane:
- First .... Juan Araneta, Occidental Negros.
- Second .... Vicente Sanchez, Mindoro.

Best purple cane:
- First .... Florencio Noel, Cebu.
- Second .... Demetrio Lorena, Oriental Negros.

Best green or yellow cane:
- First .... Pantaleon Galura, Nueva Ecija.
- Second .... Luis Ferrer, Cavite.

Best assortment of varieties:
- First .... Maximino Jalandoni, Iloilo.
- Second .... Julia Paras, Pampanga.

Best sugar ready for market in containers:
- First .... Inchausti & Co., Iloilo.
- Second .... Alejandro Policarpo, Nueva Ecija.
- Honorable mention .... Viuda de Tagle, Oriental Negros.

Best panocha:
- First .... Tomas del Mundo, La Union.
- Second .... Bonifacio Ermitaño, Cavite.

COFFEE.

Best sample:
- First .... Pedro Gaco, Cebu.
- Second .... Segunda Alisangco, Ilocos Sur.
- Honorable mention .... Sr. Yap, Cebu.

CACAO.

Best sample:
- First .... Bartolomé Bañares, Albay.
- Second .... Segunda Alisangco, Ilocos Sur.
- Honorable mention .... Paulino Dianco, Capiz.

RICE.

Best paddy rice:
- First .... C. R. Manuel, Nueva Ecija.
- Second .... José Sociapco, Tarlac.

Best upland rice:
- First .... Mandao,[1] Bukidnon.
- Second .... Dulian,[1] Ifugao.

Best glutinous rice:
- First .... Arcadio Recometa, Nueva Ecija.
- Second .... Augustino Alvarez, Capiz.

Best pinipig:
- First .... A. de Alvarez, Capiz.

Heaviest five heads of grain, in head:
- First .... E. L. Worcester, Nueva Ecija.
- Second .... Vicente Melencio, Nueva Ecija.

CORN.

Best exhibit of five ears:
- First .... J. Spirig, Moro Province.
- Second .... Florencio Noel, Cebu.
- Honorable mention .... Antonio Gonzaga, Occidental Negros.

Heaviest liter of shelled corn:
- First .... J. Spirig, Moro Province.
- Second .... Antonio Gonzaga, Occidental Negros.

MILLET.

Best exhibit of ten heads:
- First .... Pedro Rances, Bohol.
- Second .... Faustino Salvador, Cebu.

SESAMUM.

Best liter of seed:
- First .... Honorio Lasám, Cagayan.
- Second .... José Sociapco, Tarlac.
- Honorable mention .... José Barrios, Capiz.

CORN-BLADE FODDER.

Best sample:
- First .... Chas. Schück, Jolo.
- Second .... Pablo Tan, Leyte.
- Honorable mention .... Florencio Noel, Cebu.

[1] Non-Christians.

DRY FORAGE.

Best sample:
- First .... Albert F. Keil, Moro Province.
- Second .... Leandro Reyes, La Laguna.
- Honorable mention .... R. T. West, Moro Province.

GREEN FORAGE.

Best sample:
- First .... M. Magno, Rizal.

RUBBER.

Best sample:
- First .... Basilan Plantation Co., Moro Province.

TAPIOCA STARCH.

Best sample:
- First .... B. M. González, College of Agriculture.
- Second .... Vicente Bartolomé, College of Agriculture.

ARROWROOT STARCH.

Best sample:
- First .... Pablo Ligones, Bohol.
- Second .... Daniel Dado, Capiz.
- Honorable mention .... Juan Lomuntad, Samar.

TACCA STARCH.

Best sample:
- First .... Amando Laparan, College of Agriculture.

SWEET POTATOES.

Best exhibit:
- First .... Eugenio Villanos, Tarlac.
- Second .... Miguel Cordova, Capiz.
- Honorable mention .... Severino Claren, Bohol.
- Honorable mention .... Chas. Shauger, Samar.

YAMS.

Best exhibit:
- First .... Felipe Sespon, Bohol.
- Second .... Ruperto Sarmiento, Cebu.
- Honorable mention .... José Bugarin, Cebu.

GARDEN TRUCK.

Best tomatoes:
- First .... Frederick Fisher, Pampanga.
- Second .... Enrique M. Barretto, Rizal.

Best potatoes:
- First .... Wenceslao Vabra, Nueva Vizcaya.
- Second .... Pantaleon Bacomo, College of Agriculture.

Best chili:
- First .... Pantaleon Bacomo, College of Agriculture.

Best squashes and gourds:
- First .... Inocencio M. Delgado, Bulacan.
- Second .... Vicente Rivera, La Union.

Best sincamas:
- First .... Pelagia Serrano, Tarlac.
- Second .... Rafael Sarmiento, La Union.
- Honorable mention .... Inocencio M. Delgado, Bulacan.

Best cabbage:
- First .... Ceferino Joven, Pampanga.

FRUITS.

Best bananas:
- First .... Buenaventura Dimaguila, La Laguna.
- Second .... Inocencio Delgado, Bulacan.

Best citrus fruits:
- First .... Nicolas Alba, Capiz.
- Second .... Felix Cuenca, Cavite.

Best mangos:
- First .... G. Medina, Cavite.

Best general collection of fruits:
- First .... Lais Trading and Development Co., Davao.

NURSERY EXHIBIT.

Best nursery exhibit:
- First .... Tanauan Intermediate School.

ORNAMENTAL PLANTS.

Best general exhibit:
- First .... Luzon Floral Co., Manila.
- Second .... Regino Fermin, Manila.
- Honorable mention .... Wm. S. Lyon, Manila.

PEANUTS.

Best exhibit:
- Honorable mention .... Macario Gantuanco, Cebu.

KAPOK.

Best exhibit:
- Honorable mention .... Henry Fleisher, Oriental Negros.

CASTOR BEANS.

Best exhibit:
- Honorable mention .... Gelasio Tabiana, Iloilo.

GINGER.

Best exhibit:
- Honorable mention .... Josefa de Guzman, Bulacan.

GABI.

Best exhibit:
- Honorable mention .... Solano Anceta, Samar.

MUNGO.

Best exhibit:
- Honorable mention .... Agapito Tating, Antique.

THE MACHINERY EXHIBITS, FIRST PHILIPPINE EXPOSITION.

By Frank L. Strong, M. E.

The machinery exhibits at the Manila Exposition of 1912 were far in advance of those of former years and are an indication of the rapid increase in the use of machinery in the Islands. The range covered was extensive, the samples shown were the best of their class, and interest was enhanced by many of the machines being shown in actual operation.

The Government coöperated with exhibitors as never before, lending every assistance in providing a large and suitable building, steam boilers and other essentials. The exhibitors owe much to Capt. Frank P. Helm, Director of Navigation, who was in charge of the erection of the building and its decorations, and who was untiring in his assistance with a large working force of laborers. Under his supervision a beautiful electrically lighted fountain was placed at the main entrance to the building, adding greatly to the scenic effect. Every portion of the great building was ablaze with electric lights, machines innumerable were in motion, and crowded as it was at all hours with delighted and astonished spectators the Machinery Hall was beyond question the most attractive feature of the Exposition.

The main portion of the building was in the form of a rectangle, with wings at either end. Entering the southern wing one was attracted first by the exhibit of the Philippine Acetylene Company, where, in addition to lights, a new process of welding was shown, large pieces of cast iron being perfectly and quickly welded. Near by were exhibits of the Alhambra Cigar and Cigarette Manufacturing Company, the Germinal Cigar and Cigarette Factory, and the Compañía General de Tabacos de Filipinas, whose cigarette machines were shown in operation, together with fine exhibits of cigars.

Entering the main building, the exhibit of H. R. Cooper & Co. was seen on the left, showing a locomotive with a complete assortment of track material, hot-air engines in operation, kerosene engines and woodworking machinery. Opposite was shown the exhibit of Fred Wilson & Co. consisting of a fine assortment of rice machinery, a portable engine and boiler of a late improved English type, transmission machinery, etc.

The southeastern portion of the building was completely filled

with the extensive exhibit of the Pacific Commercial Company, in which were seen several large irrigating pumps in full operation throwing huge volumes of water, a sawmill, concrete mixer, rock crusher, kerosene engines, ice machine, electric machinery, portable engine and boiler, hydraulic rams, traction plowing engine, an assortment of plows especially adapted for Philippine soils, saws, etc.

In the center of the building an artistic booth was erected by the Manila Electric Light and Power Company, filled with a large assortment of electric household and shop devices. A miniature electric locomotive ran around the upper part of the booth attracting great interest, especially among the children.

The northwestern portion was occupied by Germann & Co. Here was seen an internal-combustion engine of 15 horsepower direct connected to a generator, and a producer-gas engine of 75 horsepower. Interest centers in this latter engine as it forms a part of an installation to be placed in the Bureau of Science for the utilization of native coals by the producer-gas process. A beautiful effect was produced by an electric waterfall from current supplied by a generator forming a part of their exhibit. Woodworking machinery, electric fixtures, a rice thresher, and a portable engine were also exhibited.

Adjoining was the exhibit of C. E. Helvie, the striking feature of which was a large road roller. A hand fire pumping apparatus was also exhibited, and an assortment of late novelties for use on automobiles.

Next was shown the exhibit of the Brown Municipal Road Company, consisting of an improved road roller to be drawn by animal power, and a water cart.

The remaining portion of the building, the northeast corner, was filled with the exhibit of Frank L. Strong. Here were shown electric motors and generators, a steam engine, ice plant, blowers, woodworking machinery, marine and stationary kerosene engines, steam pumps, diving apparatus, pneumatic tools, an attractive display of saws and household electrical equipments. Great interest was shown in a large ball suspended in the air by the blast from one of the fans exhibited, and there were many speculations as to its cause.

In the north wing was placed the exhibit of the Milton E. Springer Company, consisting of saws, oils, and shelf hardware. A fine display of saws and tools was made by John Simmonds & Co. The remaining space was filled by the Bureau of Navigation with the most remarkable display of lighthouse apparatus ever witnessed in the Islands. Here was seen a first-order light of enormous proportions and very great cost, revolving as when

in actual use, throwing its powerful beams in every direction. Other lesser lights were also shown in operation, illustrating the colored and flash features.

The very great progress in lighting the Islands was graphically illustrated by a very large map on which were placed minute electric bulbs in the exact position of every lighthouse in the Archipelago, over 100 being so shown. Models of the new breakwater and piers were exhibited.

The Vacuum Oil Company, while making no special exhibit, furnished without charge oils for practically all the machines in operation in the building.

Outside the building was shown a copra dryer installed by Z. K. Miller, machinery expert of the Bureau of Agriculture, a timely invention and one from which much benefit should be derived in this most important industry.

This first real machinery exhibit in the Islands, large and varied as it was, represents but a small fraction of the machinery carried in stock by Manila dealers. There is no more hopeful sign of a people's progress than the extensive purchase of machinery, and this varied assortment shown at the Exposition illustrated the astonishing advances made by the Filipino people in material things during the few brief years of American occupancy. The froth and foam of politics are surface indications only and too often misleading, but underneath is found what really constitutes national welfare.

The Exposition was a great object lesson; we have seen the machinery, even though it be but a small portion of the many varieties sold in the Islands; what are the results? We need go but a few steps to another building to see one of the many. Here are the exhibits of the various trade schools in which are shown furniture and other manufactures made by the native youths from the beautiful woods of the country. Does it seem possible that in so short a time untrained boys can become so proficient in the use of machinery as to produce such exquisite bits of work? These are not merely of graceful proportions and perfect polish but a close inspection shows every joint perfect, squares that are square and rounds that are round, work that will pass the inspection of experts in the trade in any country. And this is but one of many trades these young men are learning, as for example, the most excellent samples of metal work shown.

A steady and ever increasing stream of machinery is entering the Philippines, and the bountiful products of nature are being prepared for man's use. The effect is already apparent and the future will show the most far-reaching results.

THE COMMERCIAL EXHIBITS, FIRST PHILIPPINE EXPOSITION.

Arrangements had been made for a complete article on the commercial exhibits at the 1912 Exposition; however, as this article has not come to hand in time to forward to the printer with the remainder of the manuscript for the April number, the description of these exhibits will have to be confined to a simple enumeration of the names of exhibitors together with the articles presented, as follows:

E. C. McCullough & Co., Michell and other makes of automobiles; Moll & Co., Emblem bicycle and other lines; The San Francisco, large display of Regal shoes; I. Beck, Victor talking machines and a line of general goods; Estrella Auto Palace, Brasier & Delahaye automobile; Alfredo Roensch & Co., full line of sporting goods; G. T. Nepomuceno, the sculptor, with a fine display; the British American Bible Society, with a full line of their publications; E. C. McCullough & Co., electrical supplies; The United States Shoe Company, a large display of Hike shoes; C. Pardo de Tavera, Clement Bayard bicycles and other goods; James Kelly & Co., Singer cycles; F. H. Thompson, general display of bicycles, electrical batteries, and general engineering supplies; Ateneo Rizal, art exhibit; American Hardware and Plumbing Company, Cadillac and Gramm automobiles and Badger hand chemical fire engines; Cadwallader-Gibson & Co., beautiful display of furniture manufactured locally from Philippine woods; M. & R. Herrman, comestibles and general lines; Nestle and Anglo Swiss Milk Co., general lines; Manila Art Studio, art display; Erlanger & Galinger, National cash registers, Indian motorcycles, talking machines and adding machines; Eureka Paint Company, excellent display of Black Diamond brand paint.

THE 1912 CARNIVAL.

Had Manila required a vindication of the Carnival idea, had any further proof been necessary than that offered by preceding Carnivals of the value of an annual event such as the original Carnival idea has been developed into, the fifth Carnival which is still fresh in the memory of half the Far East offered that vindication and proof, and showed in a thousand and one ways that the annual "fiesta" has established itself as a Far Eastern institution.

In years past the Carnival and Exposition have been connected, financially and in spirit. The Exposition of 1912, in magnitude easily the biggest thing of its kind ever attempted in the Far East, was planned on too large a scale to permit of its being incorporated with the Carnival, which resulted in their being conducted separately, yet inseparably joined in the larger sense that they both were designed and executed to further the doctrine of Philippines prosperity.

The separation of the Carnival and Exposition resulted in both being benefitted, in that it relieved the Carnival association of the burden of expense which the Exposition has annually called for, and left its organization free to devise and carry into execution a program of combined seriousness and frivolity which will be long remembered by the thousands who witnessed and took part in it.

The directors of the Carnival of 1912 went about their business in a business-like way. A "funny man" with years of experience in carnival and exposition affairs in the United States was brought to Manila to take over the responsibility of furnishing the means by which Manila might forget its troubles and go on a week's spree. He furnished them. "Loco Lane," as the avenue of fun was named, stood for one week as a monument to his ingenuity—then was torn down. The memory of it lingers, however, and the part played by Loco Lane in developing an entirely new Carnival spirit will long remain an asset of the association.

Carnival spirits of the past have glimmered in a shadow of

uncertainty and doubt. The American idea of losing one's dignity and mixing with a care-free abandon equaled only by the Frenchman was not appreciated by the Spaniard and Filipino, who hesitated and looked askance upon those of their number who did throw dignity to the winds. This year an entirely different atmosphere pervaded everything connected with the Carnival. Whether it was throwing confetti on Loco Lane or working up enthusiasm to a fever heat over the events and spectacles which formed the less frivolous side of the Carnival, Spaniards and Filipinos joined hands with a hearty good will and the result was a most conclusive demonstration of the birth of a new spirit which came forth in the full light of day and contributed everything to the success of the Carnival. It is to this new Carnival spirit that the builders of the 1913 show must and will look for whatever meed of success they attain.

Athletics, to which the younger generation of Filipinos look for the physical regeneration of their race, played the part in the 1912 Carnival that its importance to the Islands deserved. An athletic field in the center of the Stadium, surrounded by a quarter mile cinder track, was the scene of contests in baseball, basket ball, soccer, and field and track events between amateur organizations of the Islands which kindled in contestants and spectators alike that fire of enthusiasm and spirit of rivalry which has made other countries, as it will make this one, better and stronger, and keener of wit. The crack Waseda University team of Tokyo was brought to Manila for the Carnival, and was taken into camp by some of the local amateur organizations. Teams of all descriptions, baseball, basket ball, track and field, came from all parts of the Islands to participate in the Carnival sports, some of which were held independently and others under the auspices of the Philippine Amateur Athletic Federation.

From the Stadium also took place the aëroplane flights, which occurred daily. Thousands upon thousands of people whose knowledge of aërial navigation was limited to magazine pages had their first glimpse of an aëroplane in flight, and incidentally witnessed flying under the most trying conditions possible to impose upon an aviator, as high winds added to the natural dangers of rising from and alighting on a circumscribed area. Combined with the athletic events, the aëroplane flights packed the Stadium to its capacity every afternoon.

Too much can not possibly be said of the enthusiasm of the Filipino and Spanish committees who worked long and faithfully to make their festivals such splendid spectacles. To them is due no small part of the success of the Carnival, while to those

who participated in them, already repaid for their trouble and expense by the knowledge of having contributed their individual efforts to events which far surpassed anything of similar nature ever consumated in Manila, is also due great praise.

Viewed from the cold-blooded angle of business, and answering the question "Is it worth while?," the fact that practically every business man in Manila acknowledges the benefits of the Carnival and is willing to enter more fully into the next one, is eloquent.

Financially the association finds itself in better shape this year than ever before, with all its obligations discharged, and a sufficient working capital for the ensuing year to insure an even greater show for 1913. The exact figures are not available, or a statement of the year's work would be published as a part of this article.

Without any desire to make the foregoing modest account of the success of the Carnival of 1912 a tribute to its makers, the writer feels that in spite of his knowledge of their wishes to the contrary, the gentlemen who so loyally devoted their brains and time to making the 1912 Carnival the biggest success in the history of the association should receive at least a word of appreciation, and in expressing his thanks for their efforts, he feels that he is voicing the sentiment of all those who enjoyed any part of the "annual brain dusting."

THE MANILA HORSE SHOW, JANUARY 19, 20, AND 21, 1912.

By John T. Macleod.

It is just a little over five years ago that a few public spirited and "true blue" sportsmen got together and organized the Manila Horse Show Association. With nothing in the treasury beyond the membership entrance fees, they boldly launched the first annual show in 1908, relying for prizes almost entirely on donations. Members of the association, enterprising firms, and several of the local clubs responded readily by the presentation of handsome cups, and the show proved a thorough success, coming as an agreeable surprise to the public, and reflecting the highest credit on the organizers. The patronage of an appreciative public, who cheerfully paid high prices for boxes and seats (and who felt satisfied afterwards that they had received full value therefor), left a balance of funds on hand to insure an even better result for the ensuing year; thus by careful management on the part of the indefatigable committee and the hearty support from the best class of patrons the show has gone on improving from year to year, until now it can vie with any of the high class shows in the homeland.

There is certainly no city in the Orient which can present such an attractive spectacle, and Manila may be justly proud of its annual horse show.

In the fifth annual show held in January there were horses from Virginia, Kentucky and California, France and Australia, mites of ponies from Java and Cochin China, and half- and full-bred native ponies from all parts of the Philippines—a number of varieties seldom, if ever, found together in any other part of the world—and not a poor-classed animal among them. Trotters were put through their paces at under 2.10 for the mile, and high jumpers reached within a shade of 1.83 meters. The turnouts in buggies, dogcarts, phætons and victorias, in singles, tandems and pairs, caparisoned regardless of expense, would

THE FOUR-FOOT BRUSH JUMP WELL CLEARED.

A CREDITABLE TURNOUT OF OFFICERS' MOUNTS AND HACKS.

MR. JOSÉ CARCHITORENA'S WINNERS IN THE TANDEMS.

MISS HELEN HIGGINS' BEAUTIFUL TANDEM OF DIMINUTIVE NATIVE PONIES

PLATE VII.

compare favorably in quality and beauty of style with any in other parts of the world.

There were no less than 42 classes, divided as follows: 8 in the breeding, 14 in the saddle, 14 in the carriage, 4 in the special, and 2 in the children's classes. For these there were 78 cups and 7 cash prizes of a total value of about ₱7,000. Twenty-six of the cups were donated by clubs, firms, and individual members of the association.

The show was an unqualified success from both the utility and spectacular points of view.

Considering the excellent showing made by the Manila horse show association, it certainly has a just claim to some material support in the form of an annual subsidy. The main object of the annual show is to improve the breed of horses, and the country at large derives the benefit, so that it is neither fair nor just that the association should be entirely excluded from support by a small share of the public funds devoted to such purposes. The native full- and half-bred stallions and mares, and the imported stock presented in the breeding classes, gave evident proof of the great work being done in encouraging improved breeding in the Islands, and should alone justify the association's claim to a yearly subsidy.

With a substantial subsidy at its back, the usefulness of the association would be increased a hundredfold, and it requires no mathematical genius to calculate the immense material benefit to be derived by the country from every one per cent of improvement in the breed of its horses.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—JANUARY, 1912.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Totals.
Rice	Kilos	22, 876, 243	2, 367, 890	2, 290, 538	27, 534, 671
	Value	973, 298	92, 838	93, 119	1, 159, 255
Beef cattle	Number	2, 728	198	226	3, 152
	Value	56, 611	4, 310	5, 341	66, 262
Sugar	Kilos	300, 014	8, 275	21, 500	329, 789
	Value	24, 196	693	1, 636	26, 525
Coffee	Kilos	126, 544	555	447	127, 546
	Value	40, 905	183	242	41, 330
Cacao	Kilos	142, 288	9, 178	129	151, 595
	Value	45, 284	3, 070	119	48, 473
Eggs	Dozens	455, 184	166	150	455, 500
	Value	36, 056	21	17	36, 094
Raw cotton	Kilos	52, 660			52, 660
	Value	14, 305			14, 305

EXPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Totals.
Hemp	Kilos	11, 458, 793	2, 879, 772		14, 338, 565
	Value	1, 116, 616	310, 094		1, 426, 710
Sugar	Kilos	2, 054, 220			2, 054, 220
	Value	125, 895			125, 895
Copra	Kilos	6, 657, 708	2, 633, 284	50, 600	9, 341, 592
	Value	624, 793	257, 717	4, 400	886, 910
Cigars	Number	17, 330, 380			17, 330, 380
	Value	245, 232			245, 232
Cigarettes	Number	3, 232, 550			3, 232, 550
	Value	3, 004			3, 004
Tobacco	Kilos	2, 227, 321			2, 227, 321
	Value	297, 212			297, 212

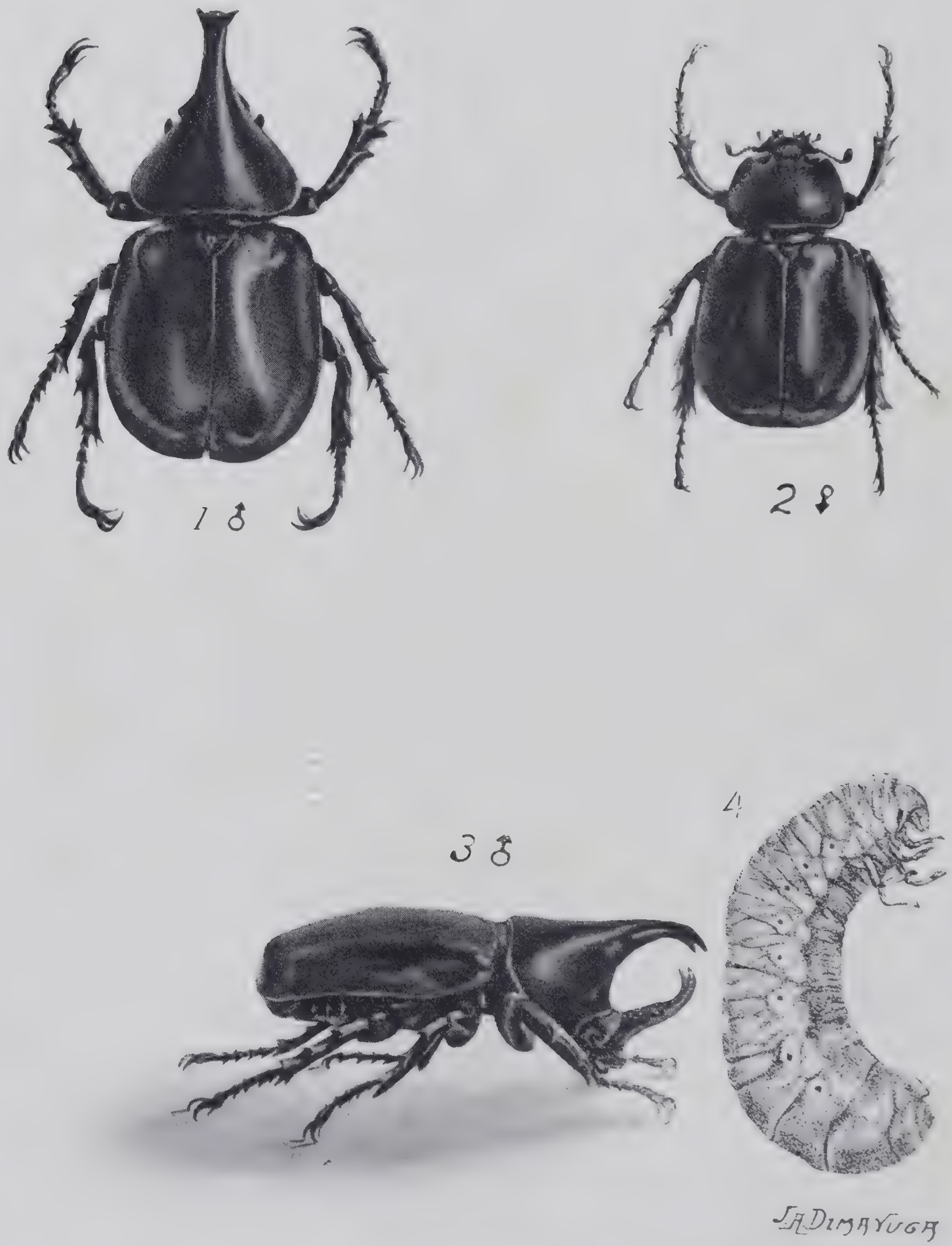


FIG. 1. Adult ♂.
2. Adult ♀.

FIG. 3. Adult ♂, side view.
4. Half-grown larva.

PLATE I.—XYLOTRUPES GIDEON L. (?)

COCONUT NUMBER

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VOL. V | MAY, 1912 | NO. 5

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

THE COCONUT.

By O. W. BARRETT, *Chief, Division of Experiment Stations.*

"Copra, the next boom," has been the watchword of the tropical planters for two years now—ever since the famous rubber boom came and went. In fact for several years the far-seeing capitalists and estate owners in the Old World Tropics have been quietly shaping their plans to this end.

To be sure, there is to-day scarcely a single plantation on

which the expert cocologist (to borrow a word from the future) would not find plenty of faults; but the way is opened and a few years hence the coconut will come into its own.

In the pestilential swamps along the tide-flushed creeks and bayous of Zambesia, with black-water fever to fight and locusts and thieves galore, the plantations are slowly but surely extending; in the savage Solomons, even on Malaita in the New Hebrides, famous in fiction as the very most dangerous place for the white man to try to start anything (except cemeteries), the cult of the coconut has many firm followers; in former cinnamon gardens in Ceylon, upon mountain slopes far from the sea in the Philippines, and out on remote dots of atolls in the wide waste of the Pacific—in all and over all the good old coconut stands for the daily bread and the base of trade to a host of various kinds of men. From Madagascar up around to Formosa and off down to Tahiti and mostly everywhere within that 33,000-kilometer (20,000-mile) triangle there is copra: delicious fresh nuts to eat and drink, and bursting bags full of the dried "meat" to sell (and smell).

While the good work proceeds, the critical bystander—the one who always has the artificial rubber story up his sleeve—points out that West Africa *doesn't* make copra and the Western Hemisphere *hasn't;* true, but the former region is still too busy with the exceedingly cheap and abundant wild oil palm, while tropical America prefers to handle the nuts whole (they make good ballast for the freighter's return trip). It is worthy of note that the aforesaid bystander never threatens the jolly coconut-oil merchant with any *artificial-oil* bogey—whatever rubber may finally prove to be, oil is always oil.

Millions of people have been consuming thousands of tons of coconut products without really knowing or appreciating just what they were eating; the time has now arrived when the world is interested in knowing more about coconut foods, and the belief in the wholesomeness thereof is becoming one of the best features of the question. Animal fats, oils, and tallows, some of which were of a questionable nature from the sanitarian's point of view, are now shown at a disadvantage in some respects when compared with the pure and germless vegetable butters and oils. This means *more coconuts.*

The new interest in coconut culture is evidenced in the Philippines by the numbers of requests for information coming to the offices of this Bureau and by the increasing number of prospective purchasers of coconut plantations here. It is estimated

that the Island of Mindanao alone has now upwards of 25 new estates in the hands of American planters, and as several of these plantations are being laid out in accordance with modern ideas they will undoubtedly serve as models for the whole world in the new science of "cocology." A number of companies have even taken up virgin lands and in some cases these are outside the regular transportation routes. There are probably about 40,000,000 coconut trees now planted in the Philippines, but probably not more than one-fourth of the suitable land has been taken up thus far.

Sugar with *plenty* of capital is good; tobacco is occasionally very profitable; and rubber would be advisable in a droughtless typhoonless region; but coconuts are probably the surest, most generally dependable of the "gross culture" crops of the Tropics to-day. Golden opportunities are awaiting the investor here.

To forewarn is to forearm: the illustrations in this issue would seem to be of a negative or pessimistic character, since they deal only with the dark side of coconut planting; however, the industry will stand investigation on all sides, and it is hoped that the present number of the REVIEW will help the planter to better understand some of the dangers which beset his path: he will have plenty of joyfulness left over anyway.

SOILS AND LOCATIONS FOR COCONUT PLANTATIONS.

By O. W. Barrett.

Scarcely a decade since, the prevalent belief in connection with soil fertility was that the growth and vigor of a plant depended very largely upon the mineral constituents of the soil. In other words, the balance of the mineral elements was paramount in determining the productiveness of a certain plat of earth; and much valuable time and effort was spent, not to say entirely wasted, in the work of attempting to determine just what were the most "nutritious" combinations of the mineral and chemical substances of soil "samples." Analyses were carried out to the third decimal point in soil laboratories throughout the world; but when the practical tests of the plant growers failed frequently to check up with the dicta of the analyzing chemists, the agricultural experts of the world finally concluded that there were tremendous discrepancies between analyses and the actual results, which according to the old theory *should* be in evidence in the fields from which samples for the analysis were taken; and from that conclusion to the discovery of the true basis of soil fertility was but a short step.

In other words, if soil fertility did not depend upon the mineral constituents of the soil as was evident, it must depend upon either the physical condition, or upon the minute organisms which were known, even before that time, to exist, especially in the superficial layers of all fertile soils—or both. Hence to-day the old theory of chemical values is put away as a curious relic in the history of agricultural science and now the adherents to the "physical condition" theory as the principal basis of fertility are losing ground somewhat in the face of the wonderful progress of soil bacteriology.

There are still, of course, many features of soil influences which are far from being understood but the principal points which have been worked out to satisfactory conclusions, by agronomists and biologists are:

(1) Microörganisms normally exist in vast numbers in "rich"

soils and in moderate numbers in ordinary soils, and are comparatively rare in unfertile soils; and therefore

(2) The degree of fertility is pretty nearly in direct proportion to the quantity of bacteria and other associated micro-organisms;

(3) The offices of these germs in the soil are not fully understood as yet, but they are known to not only cause the disintegration of the mineral particles of earth, but to produce a variety of gaseous and liquid by-products, resulting from their vital functions in the process of "tearing down" the inorganic and organic molecules, and from their own decay, thus furnishing straight to the plant roots soluble forms of nourishment which the roots would otherwise be unable to obtain, even though there were an abundance of moisture and all mineral elements in the soil itself;

(4) These minute purveyors and assistants to the root-hair branches of the roots of plants are influenced, for better or for worse, as the case may be, by other and sometimes exceedingly injurious organisms in the same soil; it is now definitely known that certain animalcules, like amœbæ, prey upon the beneficial bacteria; and, on the other hand, certain species of inconsequential character *per se*, leave toxic excretions in the soil water around them, and these substances naturally affect the vigor of their better neighbors, the friends of the plant;

(5) Certain excretions of plant roots are now (since 1907) known to be exceedingly inimical to the growth of certain other species of plants in a given soil area; for instance, the roots of grasses, bamboos, etc., excrete highly poisonous elements into the soil water in contact with them, thus reducing the vitality of and, in some cases, actually killing the higher plants in their vicinity;

(6) The amount of air in the soil affects the number and vigor of most soil bacteria; generally speaking, beneficial bacteria increase more rapidly and resist their enemies better when the soil is *well ventilated;* that is, when it contains a comparatively large percentage of the atmospheric gases.

Putting it briefly, coconut roots are helped or hindered in their growth by soil bacteria, by weeds, and by soil ventilation; translating this into economic agronomy terms, coconuts grow well when beneficial soil bacteria are numerous about their roots, when no poisons from grass roots, etc., can damage their vigor, and when a due amount of atmospheric oxygen can permeate among the soil particles about their roots so that the adjacent colonies of the beneficial bacteria are stimulated.

Nowadays the coconut planter does not need to be told that clean cultivation is *proper* even if he cannot always afford it. He knows also that bad drainage, which means bad ventilation, spells failure as far as his economic yield of nuts is concerned. He knows that a shallow soil, which is likely to dry out so that the bacterial functions are suspended or deranged, not only retards the growth of his palms, but is indirectly a very serious matter considered in the light of the above principles. Putting it in another way, he knows that the coconut is a living organism, the fundamentally important part of which has to be in the surface soil of his plantation, and that all influences which make for the healthfulness of the roots of the said crop will sooner or later affect the income from his plantation.

Since the coconut does not have a taproot, as most of the higher plants do, it would naturally seem that deep soil is unnecessary, and in a measure this is probably true; but considered from the purely physical side of the question, deep soils are safer as regards permanent moistness, which is, of course, an essential feature for highly productive soils; sandy soils, being naturally well ventilated because of their physical texture, favor the healthy development of coconuts. The coconut root having no root hairs, as do the roots of the higher plants, it follows that the comparatively coarse roots of the tree require a rather high degree of moisture without any danger of prolonged drought.

In the deep alluvial soil of the Zambezi Valley the writer has noted coconut roots running to a depth of 2 meters, though, of course, the larger number of roots are confined to the first 80 centimeters below the soil surface, the deeper-going roots being probably only water-gatherers. By the way, from the fact that a tree like the coconut has a huge mass of leaves at the top of a tall slender trunk and has absolutely no taproot (which is supposed to be requisite as an "anchor" for such trees as rubber), and yet withstands strong winds better than most trees, even those that *have* taproots, we are forced to discard another good old theory; the rubber planter, the orange grower, and the general tree culturist should remember that it is the lateral roots of the tree which really anchor it in the soil, and in transplanting trees, especially into soil which is not conveniently handled with a shovel, the sensible plan is to regard the taproot as a practically useless and cumbersome appendage, and to cut it off with shears or pruning knife.

The old belief that the coconut enjoys the proximity to sea water is gradually dying out, though it still remains in the mind of the average coconut grower. It has even been suggested that

a coconut requires the sea breeze to attain its best development. The fact is, all wind movement is more or less detrimental to plant tissues since the strain thrown upon the separate cells of leaves and stems by the bending and twisting action of the wind is injurious to the steady circulation of sap and may easily result in shock to the very delicate, jelly-like, protoplasmic contents of the growing cells. Students of biology and meteorology could readily tell us that the circulation of sap in plants does not to any appreciable degree depend upon the stretching and straining action of their tissues but upon certain factors like osmosis and capillary diffusion, while "there is about as much need of the winds' stirring up the atmosphere to prevent concentration of oxygen over the surface of the leaf, for instance, as there would be in agitating the ocean to prevent an incrustation of salt over the surface on account of the evaporation therefrom."

Many years ago coconut planters in some countries believed that the use of salt around the roots of coconuts was beneficial, especially at a distance from the seacoast, the idea being that the palm delighted in sodium chloride, which is with few exceptions a violent poison to the more highly differentiated plants—the nipa palm happens to be a striking exception to the rule. The only sensible reason, in the experience of the writer, which has been given for the use of salt about young coconuts is that it might temporarily *prevent the attacks of injurious insects*. The real reason for the apparent preference of coconuts for the seashore location is based upon the fact that all heavy clayey soils, which hold moisture throughout the year and upon which falls a comparatively large amount of rain, naturally foster a far greater number of weeds and grass; thus in hilly countries or on comparatively high ground coconuts frequently give a light yield, but not because of distance from the seashore. In fact, some of the best coconut plantations the writer has seen were located many kilometers from the seacoast where no breath of sea wind could reach them. There is, of course, something in the altitude, or at least in the great diurnal range of temperature which occurs, of course, in high elevations; all plants are more or less sensitive to these severe changes in temperature and the great bulk of vegetable tissues are impatient of even moderately low temperatures. In other words, high altitudes are impossible for the proper development of most tropical plants.

The coconut endures an elevation of 500 to 800 meters, but above 1,000 meters the temperature conditions are not favorable. Dr. O. F. Cook reports coconuts thriving in central Guatemala up to a height of some 800 meters. The writer was greatly im-

pressed with the comparative vigor of the coconuts on the north side of Banajao in Laguna Province; though the plantations were execrable from the expert agronomist's point of view, being not only choked up with brush and tall grass but the trees themselves standing at least twice too near together, the vegetative condition of the palms was all that could be desired.

The simplest means of ventilating soil in coconut plantations, though actually necessary, however, only in heavy soils and in young plantations, is the vertical-forking method, proposed by the writer in 1907 in a lecture before the Agricultural Society of Trinidad and Tobago, in the West Indies. This consists in forming vertical openings through the surface layers by means of strong-tined forks, the fork being thrust into the earth to a depth of 10 to 20 centimeters, then loosened by moving the handle of the fork back and forth, or sidewise, and, after sufficiently loosening the tines, withdrawn without any prizing action (which might break the roots that come into contact with the tines). From four to eight, or more, thrusts should be made in every square meter of surface. This operation not only allows the air to enter layers of the soil, but the holes themselves collect fine humus and surface material, especially if there is sufficient rainfall to move such substances on the surface; thus the bacteria about the plant roots are furnished a handy supply of nourishment without expense and without disarranging the balance or checking the operations of the microörganism colonies in the soil; plowing would be both too severe and too expensive.

Plowing cannot be done with safety near coconuts; harrowing, except superficial cutting and tearing of weeds and grasses by means of a disk or rotary harrow of some light-weight type, is inadvisable, and fertilizers are questionable in ordinary cases, but the vertical-forking method is exceedingly simple, far cheaper than spading, and much less dangerous to the coconut roots, and is the only practical means of ventilating the earth in heavy soils without injuring the tree.

VARIETIES OF COCONUTS.

By O. W. Barrett.

Throughout the coconut plantations of the world there appear to be only two varieties under general cultivation, and these two are so closely alike that the ordinary observer fails to note any difference.

The exact number of forms and varieties of the species (*Cocos nucifera*) is probably in the vicinity of 25; of these not more than 10 are sufficiently common to be worthy of mention as economic varieties.

Besides the ubiquitous "green" and "yellow" forms of the plantations—these two forms being distinguishable merely by the color of the midrib of the leaf and the shade of the immature nut—the Pemba probably deserves first rank. This variety seems to be native to the Island of Pemba in the British Protectorate of Zanzibar off the coast of British East Africa. The tree is comparatively small, say, about two-thirds the size of the common coconut, the nut being of a distinctly pale yellow color with a more or less shining surface and without the prominent angles of the common sorts; the husk is comparatively thin while the meat itself is of ordinary thickness; in other words, the percentage of meat is very high in the total weight of the nut. There are but very few trees of this variety now in the Philippines.

One of the most striking varieties in the Philippine plantations is the so-called Guinaring, or Ivory; this nut appears to exist in two forms, one nearly globose, the other considerably elongated and with rather prominent angles. The color is a pale yellowish white, this feature rendering the tree distinguishable at some distance. The nut itself is not quite up to the standard as to the thickness of meat, flavor, oil content, etc.

The Kalimbahim, or pink-husk, is merely a form of the ordinary sort having the interior of the husk rose-colored.

The dwarf, or Dahili (or Mangipud) nut appears to be more

or less common throughout the Philippines and from its habit of early maturity and apparent prolificness it is recommended as a variety for planting in town yards, public squares, etc. It is said there is still another form of the dwarf nut which yields a very large number of very small nuts—some of them not more than 8 or 10 centimeters in diameter when husked.

It is questionable whether the so-called giant nuts of Lingayen and San Ramon are anything more than highly developed specimens of the common type; but the chances are that a nut of this type planted in a nursery with others would not only develop a stronger seedling but the plant itself would tend to show the character of the parent, even under adverse conditions. The planting of these giant nuts is not advisable, however, for the total weight of the yield per tree is probably no higher than in the case of the ordinary sort; 250 of these nuts are said to make a picul (about 63 kilos) of copra.

The edible-husk nut, or "Tagnanum," of India and the Philippines is so strikingly different from the common types that it might well be regarded as a subspecies. The value of this variety, however, is more in the line of a curiosity than as an economic. The husk is more or less saturated with a sweet sap carrying a slight percentage of astringent substance.

The Macapunó is rather a sport, or freak, nut than a distinct variety. There is no question but that the average Filipino coconut grower can readily distinguish by "weighing" in the hand these nuts from others in the pile. Furthermore, it is certain that the coconut pickers know from experience which trees in a grove are likely to produce these nuts. Its remarkable character consists in the cavity being more or less completely filled with "meat." This abnormal kernel, strictly speaking, has nothing to do with the spongy mass of the "embryo foot," the special organ which transforms the albumenoid substance of the kernel into soluble plant nourishment for the use of the sprouting shoot. The Macapunó apparently has a tendency to ferment if kept for any considerable time. The quality of the flesh of the Macapunó is decidedly superior for use in making "dulces," since it lacks the fibrous texture of the ordinary kernel. It is probable that a genuine Macapunó could never germinate, though by the same token it is possible that a tree grown from a normal nut of a "Macapunó" tree would be very liable to show that sport.

There is a common belief that the "meat" from certain trees is sweeter and tenderer than from others; this is probably true in a measure, but it is a question whether nuts from a "good

eating" tree can be depended upon to reproduce true to the parent type.

In passing, it may be remarked as a strange fact that a plant, which has been cultivated for at least several thousand years and which is to-day one of the most indispensable plants in the world, should not have run into more numerous varieties. Originating, it is believed, in the mountainous regions of Central Colombia in northern South America, carried westward across the Pacific long before the dawn of civilization, and now grown more or less extensively in every frostless region of the world where droughts are not too inimical, this species has kept remarkably free from sports and modifications. The genus itself is a large one but without exception all the species, except *C. nucifera*, are confined to the American tropics.

On a par with the coconut may be considered the banana; though the latter is pretty certainly a species of more recent domestication, there are probably upwards of 100 varieties of the species known as *Musa sapientum*, with as many more of the very closely related *M. paradisiaca*, besides dozens more of the three or four other similar species.

One other feature should be borne in mind in regard to the distribution of the coconut: it appears from data gathered by Dr. O. F. Cook of United States Department of Agriculture, Washington, D. C., that the coconut is absolutely dependent upon man for its distribution; that is, the nuts do not, as was formerly believed, germinate after having been floating in sea water for a long time, as would be necessary in traveling in ocean currents from one country to another. The sponginess of the husk, in other words, is not for the sake of buoyancy in the water, but is actually a padding material to break the force of the shock in falling from the crown of the tree.

About twenty "named varieties" are known in Malaya.

COCONUT PESTS.

By

O. W. Barrett

and

D. B. Mackie, *Agricultural Inspector.*

Though the coconut palm is already subject to the attacks of many and varied forms of animal life, as well as the host of different cryptogamous parasites, yet as the areas devoted to its cultivation are extended it often happens that pests hitherto hardly worthy of the planter's consideration have multiplied to the extent of being decidedly obnoxious. In spite of this and the fact that almost every year yields its new pest either naturally or by importation none have yet appeared that can not with a reasonable amount of attention be controlled.

In order of their importance these pests may be arranged as follows: (1) Insects; (2) diseases; (3) mammals; (4) birds; and (5) crustacea.

INSECTS.

Of the seventy-five or more recorded pests of the coconut there are only some five or six species that are actually injuring the crop to any great extent; and of these only two are of prime importance in the Philippines.

The beetles of the Lamellicorn family are probably of more importance throughout the coconut countries than all the other pests combined. The weevils come next, and the scales third; but in certain limited regions, as north Madagascar for instance, other species may rank as far more serious pests than either of these types.

Throughout the Philippine Archipelago, and in fact in all southern Asia and the Malaysian regions the uang, or rhinoceros beetle (*Oryctes rhinoceros* L.), causes a tremendous amount of damage. Worse still, this pest has never been, with perhaps one or two exceptions, consistently fought and controlled. It has virtually robbed the pockets of the copra producers of many

million pesos; yet its life history is not well understood by the average planter and in most estates it is allowed to breed with little or no effort toward exterminating it. A desultory attempt is usually made in the best plantations to destroy the adult beetles found in the act of burrowing into the heart of the trees; but this is working backward, as it were: it is the same old story so common in tropical agronomy—of plenty of "cure" work, but not much "prevention" policy.

The two principal points beside actual hand killing of the uang to be considered in the destruction, or rather the control, of this terrible pest are the entire removal of the stumps of dead coconuts, and the baiting of the adult beetles by means of "tuba" trees.

There is no question but that the uang finds an ideal breeding-place in the bases of old coconut stumps, the more or less hard exterior and the porous interior rendering the retention of moisture in the stump a practical certainty, even through long droughts; this moisture is, of course, necessary to the well-being of the grub—in fact, they could not live in any dry material. Unfortunately the average planter is liable to think he has done his part when he fells a dead or dying tree and removes or burns at least the greater part of the crown (in the case of bud-rot) and trunk; but the danger begins as soon as the trunk base commences to disintegrate, say, within six months after the felling of the palm. Putting it briefly, one old stump within one kilometer of the coconut plantation may breed a hundred or more uang beetles every year for some two or three years. Furthermore, the stumps of *any* palm, and even the logs or stumps of soft-wooded trees, bagasse heaps, or piles of any decaying vegetable matter furnish breeding grounds for the larvæ of this pest. As many as 76 grubs and pupæ have been found in one old coconut stump.

Immediately upon emerging from the pupa stage, which is, of course, passed in the same place as the larval stage, the mature insect emerges and, like most other members of the family, they at once seek food; in fact they may eat more or less during several months after becoming winged.

Details of the breeding habits as to the mating season, the number of periods of egg laying, the female's length of life after oviposition and the male's after copulation are largely wanting; but any intelligent planter can readily learn these facts by close observation. It is hoped one or more parasites of the grub may be discovered; and if such do exist they may be reared in large numbers and liberated in badly affected localities.

The occurrence of larvæ in the burrows of the adults on the tops of coconuts has been reported but it is probable that this occurs very rarely and only in very badly attacked trees where numerous burrows have been made down into the center of the bud so that the sap of the plant exudes into the burrow, this furnishing sufficient moisture for the young grub.

The odor of fermenting sap from trees which are used for tuba production is apparently very agreeable to the adult uang and it is probable that a systematic tapping of the trees, say, one "tuba" to every 100 trees on an estate known to be affected by uang, would probably result in the trapping of practically all of the pests in one season. If a laborer were made responsible for the killing of the uangs gathering about the exposed surfaces of the tapped trees the operation would cost comparatively little, and the laborer could visit ten to twenty trees early in the morning while the beetles were sluggish from the low temperature. It would probably be well to pay the laborer "by the piece;" that is, a fixed price per dozen beetles.

The following point regarding the means of determining whether an adult uang has begun its attack on the bud of a certain tree may be of use: A laborer walks along the rows of palms every morning and carefully scrutinizes the surface of the ground under each tree to note whether any particles of the plant tissue (torn from the leaf bases by the burrowing beetle) have been thrown out. To locate the pest in the crown of the tree merely by glancing at the leaf bases from the ground is, of course, impossible; but if small pieces of fiber are noted lying on the ground under the tree the evidence is positive that one or more beetles have attacked the bud very recently. In India, where the uang is also very injurious in coconut plantations, the expert native can, by experience, detect the burrowing of the beetle in the top of the tree by holding his ear against the trunk, the sound of the breaking fibers being telegraphed down the tree. The legs of the insect, and probably to some extent the mandibles, are used to force apart and break off the strong fibers; the jaws are too weak for such operations: wherefore, it should be noted that the *juice*, not the tissues of the palm, furnishes the beetle's nourishment.

The uang is strictly nocturnal in habit.

The burrows made by the uang are, of course, indirectly a source of grave danger wherever the coconut weevil occurs; thus not only is the vigor of the tree more or less checked directly, but the uang opens a way for the much more deadly weevil.

Finally, the unsightly holes in the trunk and the twisted or

curled leaves in the crown of any coconut are both a reproach and a warning to the owner of the plantation. In the near future laws should be made (and rigidly enforced) in all copra countries, with the object of exterminating this greatest of all coconut pests.

Six other species of *Oryctes* infest Madagascar and the adjacent islands, while two more are reported from German East Africa, and one (*O. boas*) was found by the writer in the large new plantations of the Portuguese syndicates in the States of Quelimane (Zambesia), Mozambique.

The red weevil (*Rhynchophoras ferrugineus* Fabr.) is the second most destructive insect attacking coconuts in the Philippines. This species occurs also in India, Ceylon, Siam, Indo-China, Malaya, and a part, at least, of the East Indies; but in India, Java, and Africa the three allied species, *R. signaticollis* Chevr., *R. schach* L., and *R. phœnicis* are found respectively; in the American Tropics *R. palmarum* represents the genus alone.

The distribution of this pest in the Philippines is probably more extended than is generally supposed; no serious outbreaks, however, have occurred recently and only the following localities are known to be infected: Zamboanga, Laguna, Tayabas, and Oriental Negros.

The eggs are usually laid in cracks or fresh cuts in the stem; it is believed the grubs may enter at or near the base at the point of attachment of the roots, especially of roots *above the ground*. The life cycle is probably about one-half that of the uang, say five or six months. The footless larva constructs a crude sort of cocoon (without silk, of course) in which it passes the pupal stage. It appears the grubs are seldom found singly; a score or more may frequently be taken in one cavity. Once a cavity is formed in the interior of the trunk there is little use in trying to save the tree by destroying the grubs inside, for it would only continue a source of great danger to the tree as a decay area, even if there were no more weevils in the neighborhood to be attracted thereto. If the presence of the young grubs is promptly detected, however, the cavity or burrow may be cleaned out and drained so that water cannot remain therein, and then the entire surface of the cavity painted with tar or a mixture of pili resin and charcoal dust.

Unfortunately the red weevil is not confined to the coconut, but probably can exist in any of the large-stemmed palms; therefore, it follows that the planter must watch not only his own trees but also every buri (*Corypha umbraculifera*), cabo negro

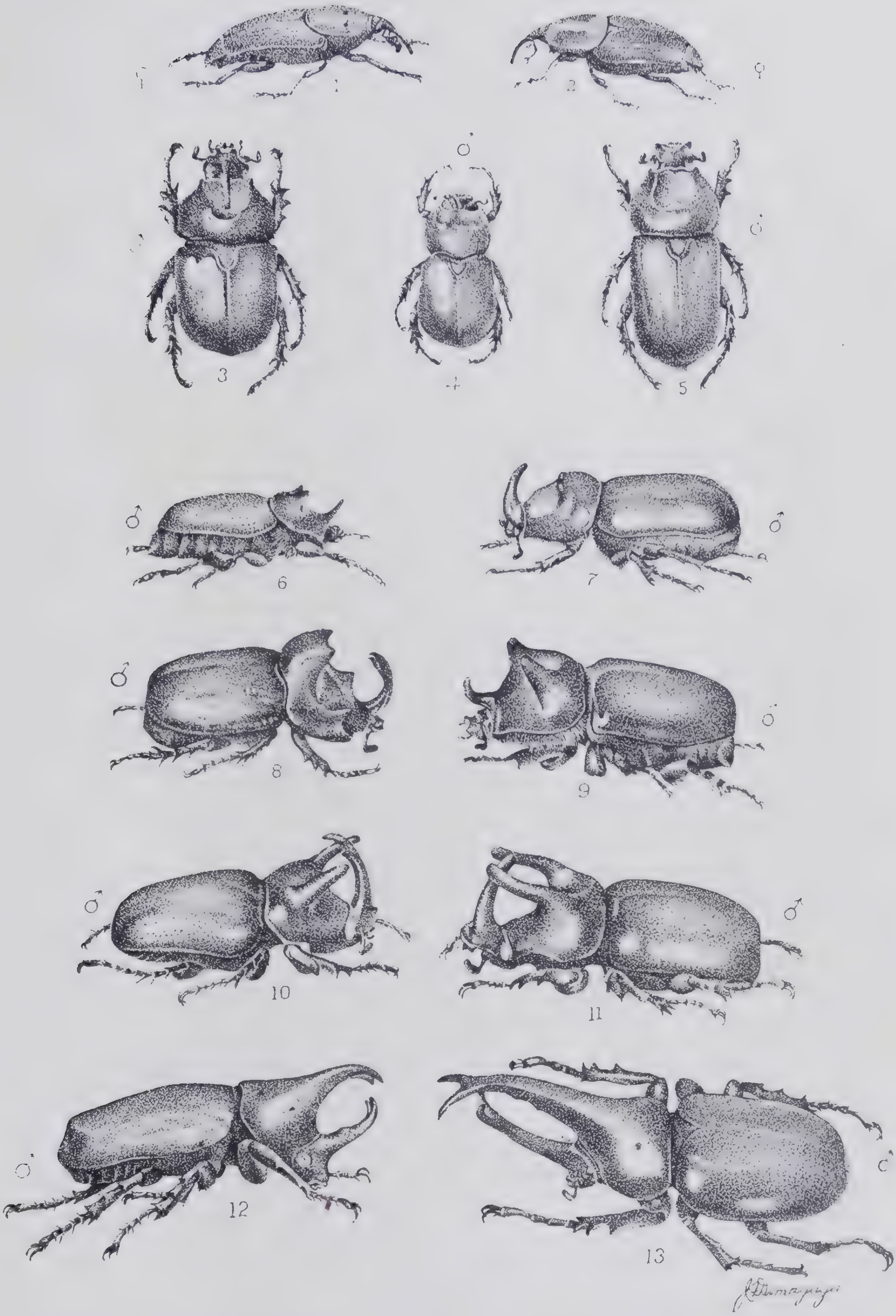
(*Arenga saccharifera*), and even wild palms and boñgas (*Areca catechu*) in the neighborhood; if a single case of infection be discovered his efforts should be trebled at once to locate the breeding place of the beetles: one valueless palm trunk in jungle or an abandoned plantation may breed enough weevils to destroy, theoretically, *several thousand coconuts within one year.*

Among other weevils affecting coconuts are: A species of *Sphenophorus,* a comparatively small reddish-brown insect with a slender proboscis; the small, rare, "shot-hole" and the "four-spotted" coconut weevils mentioned by C. S. Banks and W. S. Schultze, of the Philippine Bureau of Science; *Metamasius hemipterus* L., a small reddish-brown weevil of tropical America; and the Philippine boñga weevil (*Cyrtotrachelus* sp.) which might any day become a very serious pest of coconuts. In tropical America the bearded weevil (*Rhina barbirostis*), one of the largest of all the Rhynchophora, attacks the coconut as well as other palms, but fortunately has never become abundant anywhere.

Another pest which bids fair to rival the rhinoceros beetle in the Philippines is the similar-appearing *Xylotrupes gideon* (?); this has been reported from several provinces but not until the past season has it assumed a dangerous character. This species in Oriental Negros, Batangas, and in one locality near Manila seems to prefer young trees for its voracious attacks. A sister species (*X. lorquini*) is attracting some attention in the new plantations in New Guinea.

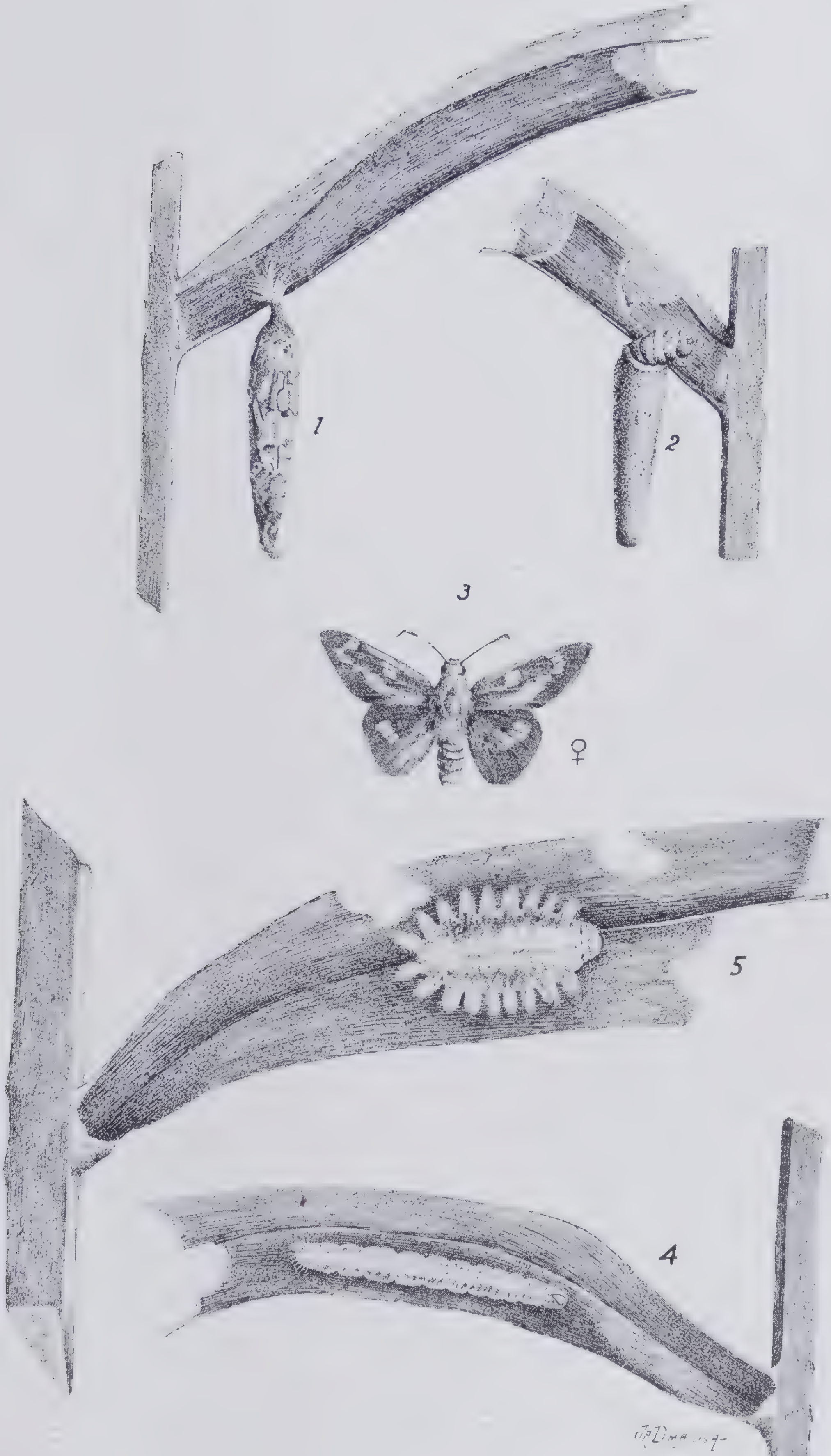
The largest and in some districts the most destructive coconut insects are those of the genus *Scapanes.* One of these, probably *S. australis* Boisd, has recently turned up in the Island of Negros; this and a sister species *S. grossepunctatus* Sternb. are very dangerous pests in New Guinea. By the way, the latter country is afflicted with several more coconut destroyers—four species of uang-like *Pimelopus,* a *Camelonotus,* a *Trichogomphus,* and an *Oryctoderes*—all more or less resembling our own rhinoceros beetle.

Perhaps the most insidious trunk-infesting coconut pest in the world is the terrible little Serricorn beetle, *Melitomma insulare* of the Seychelles and Madagascar region; this insect enters the stem at the base among the roots and, partly by its own voracity and, it is thought, by reason of "caustic liquid" excreted by the larva, soon kills the tree. The importation of any coconut material from the habitat of this pest might be attended with dire results.



1. *Rhynchophorus signaticollis* Chevr. India.
2. *Rhynchophorus ferrugineus* Fabr. Indo-Malay region.
3. *Oryctes boas* Fairm. East Africa.
4. *Camelonotus quadrituber* Fairm. New Guinea.
5. *Oryctes monoceros* Ol. East Africa.
6. *Strategus anachoreta.* Tropical America.
7. *Oryctes rhinoceros* L. Indo-Malay region.
8. *Oryctoderes latitarsis* Burm. New Guinea.
9. *Trichogomphus semmelincki.* New Guinea.
10. *Scapanes australis* Bois. Indo-Malay region.
11. *Scapanes grossepunctatus* Sternbg. New Guinea.
12. *Xylotrupes gideon* L. Indo-Malay region.
13. *Xylotrupes lorquini.* New Guinea.

PLATE II.—COCONUT BEETLES.



FIGS. 1, 2. *Bagworms.* Psychidæ.
FIG. 3. *Padraona chrysozona* Plötz. Hesperidæ.
5. *Thosea cinereomarginata* Banks, larva. Limacodidæ.
4. *Padraona chrysozona*, larva.

PLATE V.

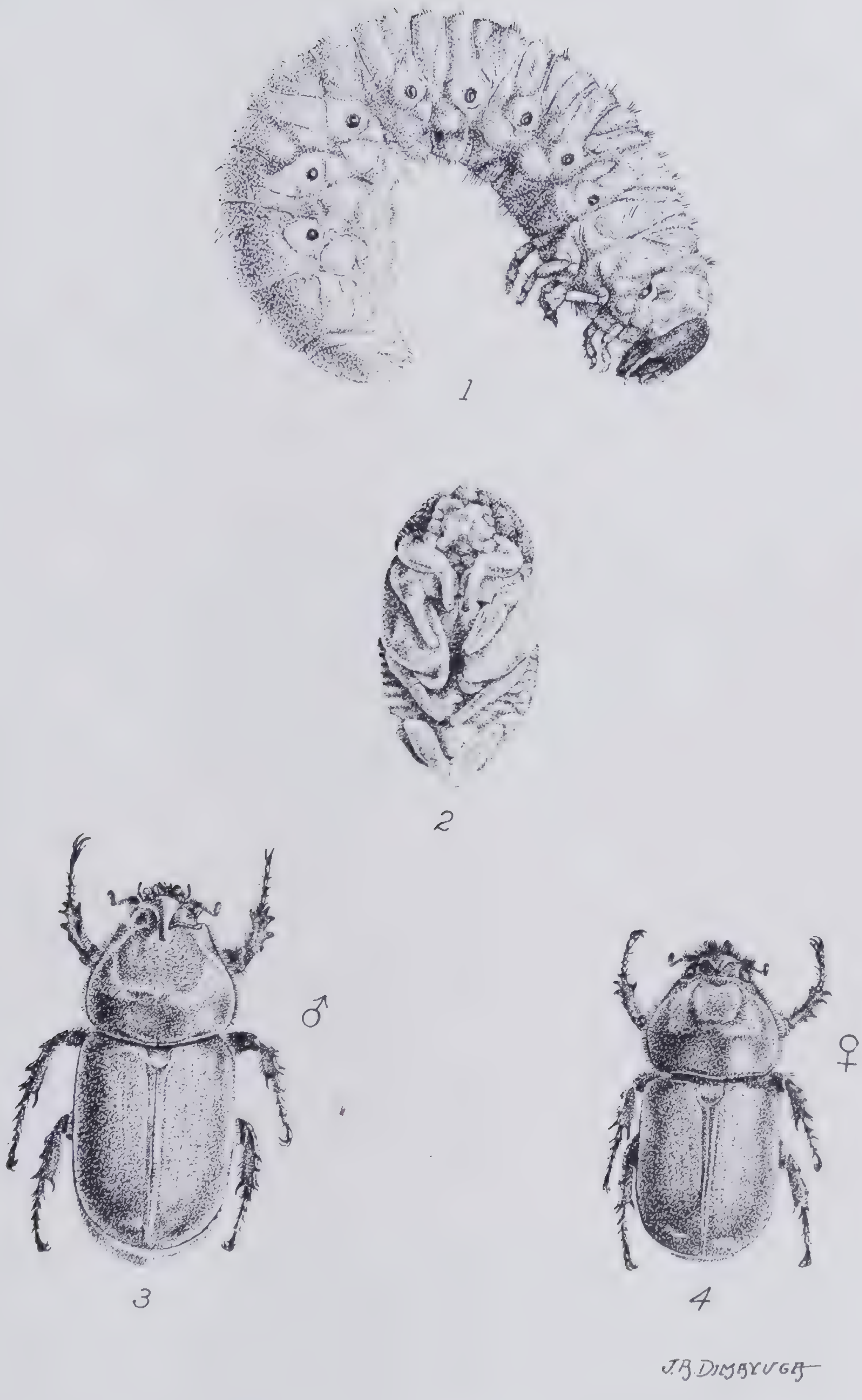


Fig. 1. Larva.
2. Pupa.

Fig. 3. Adult male.
4. Adult female.

Plate III.—ORYCTES RHINOCEROS L.

Fig. 1. Larva.
2. Pupa.
3. Cocoon.

Fig. 4. Adult male.
5. Adult female [illegible]

Plate IV. RHYNCHOPHORUS FERRUGINEUS Fabr.

Aside from the trunk-inhabiting species there are many kinds of scale insects which injure the coconut more or less, and may even kill young trees. The commonest of these, is probably the "transparent scale" (*Aspidiotus destructor* Sign.) ; it is common in many countries, and causes great damage to the vigor of coconuts in most localities of the Philippines, as well as Porto Rico, Barbados, Reunion, etc.; the writer believes it is this species which affects most of the plantations, especially near the seacoast, in Zambesia.

A new and very striking scale (*Aleyrodicus destructor* Quaint.) was recently discovered in Oriental Negros; it is figured in the REVIEW for March, 1912; it is covered with beautiful long, white, waxy filaments; a sister species occurs in the West Indies. Mr. C. S. Banks, in the Philippine Journal of Science (1906, Vol. I, No. 3), describes six more coconut scales, none of which, fortunately, are of much importance to the planter.

Several interesting, but rather unimportant (in the Philippines) kinds of coconut pests are: *Brontispa frogatti* Sharp, and two species of *Promecotheca,* which from the New Hebrides to Java attack the young leaves, boring tunnels through them; these may enter Mindanao via Celebes. *Mycterophallus xanthopus* Boisd. and a similar species from the Philippines attack the flowers and would very likely prove a serious pest if they should ever occur abundantly in a locality. Still another point of attack is that of the tropical American species of *Strategus,* large beetles resembling the uang, which in the grub stage *cut off the roots;* one of these huge grubs beneath a young coconut would certainly prevent profitable progress thereof.

The Coleoptera and Hemiptera, though much more prominent, are not alone in the lists of coconut enemies. Butterflies, moths, locusts, walking-sticks, and termites also run as more or less serious pests. *Padraona chrysozona* Plötz. is a dull-colored Hesperid butterfly which lives on coconut and betel leaves; according to Mr. C. S. Banks, the caterpillar is held in check by two Hymenopterous parasites. Another Hesperid is reported from Java. In tropical America *Brassolis sophoræ,* a large Nymphalid caterpillar, sometimes proves quite serious, leaving only the midrib skeletons of the leaflets, thus checking the tree for at least eighteen months.

In Malay, India, and Java a Zygænid moth (*Brachartonia catoxantha* Hamp.) sometimes defoliates large areas of coconut plantations in a few days. Steps should be taken to prevent this insect reaching the Philippines.

In India a black-headed caterpillar (*Nephantes serrinopa*) is sometimes a serious pest in the plantations; while in the West Indies, Surinam, and Venezuela two species of the butterfly-like moth, Castnia, and the poison-spined caterpillar of an owl moth (*Hypercheiria*) cause considerable loss to coconut planters.

Two kinds of "bagworms," one constructing the bag of nearly pure silk and the other using small pieces of the leaf mixed with the silk, are occasionally noted in the Philippines. In Manila the writers have a tree under observation, which is being gradually defoliated by the latter species; on account of the caterpillar's protective covering, these pests do not run much risk of being attacked by parasites, and hence may become very abundant under favorable climatic conditions.

A very remarkable Limacodid moth has been described by Mr. C. S. Banks (Phil. Jour. Sci.; 1906, Vol. I, No. 3); the beautiful heliotrope and emerald sluglike caterpillars are kept in check by a Braconid parasite.

Whenever a flying swarm of locusts happens to alight upon a coconut plantation the trees are usually stripped of their leaves in a few hours. Fortunately these visitations are very rare in the Philippines; but in Zambesia the trees in some districts hardly get nicely "leaved out" after one swarm before another swoops down and strips them bare again—thus preventing the trees from producing any nuts at all.

An outbreak of "walking-sticks" (*Phasmius* sp.) occurred a few years ago in Samoa and gave the planters a bad but brief scare: no such foolish insect could hold out long against bird and parasite enemies.

Termites, in some countries, are a very grave menace to the planter. In the Malabar coast it is customary to apply ashes around the nut at the time of transplanting, in order to keep the "white ants" from devouring the husk. In many localities "white ant" galleries may be noted running up the coconut trunks; the insects probably seldom ever eat anything except the dead portions of leaf-bases, fruit stems, etc., in the crown, but the wise planter will destroy all termite nests and colonies *on general principles.*

Last, but not least, a small larva, probably a Tineid, has recently been discovered here feeding upon the floral organs of the coconut; while not directly injuring the tree itself the operations of this apparently insignificant moth must needs result in the barrenness of the attacked flower clusters.

To summarize then, we have here to-day in the Philippine coconut plantations, at least eighteen insect pests, about six of which are important, and two of which are very serious and which cause the loss of many thousands of pesos annually. But, in comparison with other copra countries, we are very fortunate thus far on the pest question. With conscientious attention to the fundamental principles of agronomy and economic entomology the Philippine coconut planter can easily cope with and control all his insect enemies.

Of the mammalian pests here, the rats are undoubtedly the worst. The two or three species which occur in Philippine plantations are all easily controlled either by arsenical bait or traps as elucidated in Circular No. 13 of this Bureau.

Two or three species of fruit bats (*Pteropus*) are responsible for considerable damage, especially in the Island of Bohol. Their stupid habit of roosting, during the daytime, on trees in exposed places renders it a fairly easy matter to reduce their numbers, or even to exterminate them, by means of the air-rifle.

The common monkey (*Macacus philippinensis*) occasionally becomes a pest to be reckoned with; poisoned bait and firearms are recommended. In some districts of Africa the large day-feeding apes and the night-feeding lemurs combine to give the copra maker no little trouble.

The wild pig (*Sus philippinensis*) renders the planting of a coconut grove a very precarious proposition in many provinces; in Mindanao some planters have been forced to build fences—a difficult and expensive matter—around their young plantations. The method of setting the young palm in a deep hole to prevent the pigs getting at the nuts is, however, a remedy about as bad as the disease, since the young roots are liable to encounter only dead soil and thus make little or no growth for a year or two. Firearms, poisoned bait, and tar are prescribed. Africa and the East Indies suffer also from four or five kinds of wild pigs.

Two crows (*Corvus pusillus* Tweed. and *C. samarensis* Steere) attack the green nuts, pecking holes into them and feeding on the choice jelly inside; they are not so easily controlled as would be expected.

Birgus latro, the common Old World land crab, takes heavy toll in some localities; a brush barrier tied around the trunk prevents its ascent, and arsenic would probably be accepted without question if used to season coconut "meat" near the burrows.

DISEASES OF THE COCONUT.

By O. W. Barrett.

Coconut diseases may be divided into four classes according to the part of the plant attacked: i. e., the root, stem, bud, and leaf.

Bud-rot is certainly by far the most serious of all the fungus or bacterial diseases that trouble the coconut planter. What appears to be the same disease is now known throughout the Tropics of both Hemispheres. The West Indies have long been afflicted with it; Cuba is rapidly losing her best plantations and only stringent measures have served to keep it under control in Trinidad. Some localities of India are badly affected with the same or a similar trouble. The Philippines have suffered one serious outbreak within the last decade, but prompt measures and the excellent work of Dr. E. B. Copeland soon put it under control. It would be folly to assert that all danger is past yet, however, and eternal vigilance will be required for a long time at least—to say nothing of caution regarding plant introductions. According to Mr. J. R. Johnston's recent bulletin ("The History and Cause of the Coconut Bud-Rot;" Bull. 228, B. P. I., U. S. Dept. Agr., 1912) the West Indian disease is caused by a bacillus practically indistinguishable from *B. coli*, a germ heretofore associated principally with sewage. Since there is no "cure," it is obvious that the copra producer should take no chances even with suspicious cases in his plantation, but should fell and burn immediately every tree that displays the yellowish young (vertical) leaves.

There are probably several kinds of root diseases in both Hemispheres; thus far no case has been reported in the Philippines. The writer can not agree with the said Mr. Johnston that the Trinidad root disease is simply another phase of the bud-rot. Petch appears to have proven that *Fomes lucida*, one of the bracket fungi, causes the Ceylon root disease; this, however, seems to lack the pronounced red ring between the center

and outside shell of the trunk which is so distinctive in the Trinidad disease.

The so-called "bleeding disease" of sugar cane, pineapples, etc., attacks coconuts in India, but does not cause much worry, at least in Ceylon.

Another widely prevalent disease, *Pestalozzia palmarum*, attacks the leaves, but except in Trinidad, perhaps, does not do much damage.

A peculiar, and possibly very dangerous, disease of the ripe nut was discovered in an isolated grove on the Island of Catanduanes in 1909 by Mr. D. B. Mackie; this appeared to be a fungus disease, but from the small amount of material it was impossible to make cultures for identification. The fungus, or bacterium, or bacillus had probably entered through one of the "eyes" in the base of the nut and about one-half of the meat had been destroyed by the organism. Certain disk-like organs were noticed over the diseased area, which might have eventually become spore-bearing branches; the "slime" on a certain part of the affected area, however, would indicate the possibility of a bacillary or bacterial origin. The etiology of this disease should be worked out as soon as possible, for should it spread rapidly, as it well might if the origin be bacterial, it would be an extremely difficult matter to control and it might rival the bud-rot as a devastator of plantations. (Plate No. VI shows the half of a ripe nut infected with this unknown organism.)

Several other undetermined leaf and stem diseases occur in Tahiti, Cochin China, Siam, and Malaya.

THE NEW COPRA.

By O. W. Barrett.

Many centuries ago a Polynesian (or perhaps it was a Caribbean Arawak Indian) discovered that if he smashed a coconut and left the "meat" in the sun for a day or two he could carry the partially dried chunks of—well, of "copra"—as a reserve ration when traveling. From this great event the world derived a new lease of life: for, from the great advantage of having an extra meal tied to one's waist when tramping through wild regions to possessing a beautiful can with its most wholesome and toothsome contents, deodorized, colored, and chemically purified coconut butter—is a lucky strike in the record of human progress. Every fresh coconut is a meal—food and drink for one person; and every kilo of good copra yields two-thirds of a kilo of oil, which when refined and "fixed up" makes about half a kilo of semisolid food material plus a considerable quantity of oil-stuff.

The great trouble with handling copra is, of course, its tendency to deteriorate in storage; that is, the generation of acids and the formation of rancid substances in the "meat" reduce both the quantity and quality of the oil.

A few years more, however, will certainly see great improvements in the methods of drying and treating copra. Instead of the 5 to 10 per cent free acid content of the ordinary commercial article, this will be reduced to 1 or 2 per cent by *drying more thoroughly* and by *using only ripe nuts.* Ordinary Philippine copra contains from 10 to 15 per cent water when put on board; if the water content were reduced to 5 per cent there would be practically no loss from decay and "fermentation" en route or in bodegas. Neither by the "tapahan" (direct fire kiln) nor the sun-drying methods is 5 per cent water copra produced. But the injurious water content is not the only bad feature of Philippine copra: creosote from the smoke and shells burned in the pit of the tapahan permeates the whole material and the oil made from such smoky copra must, of course, have more

or less of the same smell and odor, and unless put through expensive processes can not be used in the manufacture of vegetable butters, nut-margarine, cooking oil, etc., nor even the better-grade soaps.

It is a strange and deplorable fact that until very recently almost all the copra of the world was made by drying either in the sun or over a smoking kiln. Such copra can not keep well—which means that millions of pesos have been lost through the loss of oil by decomposition in storage or on the half-way-round-the-world shipping routes. Oil turned into rancid substances and acids is irretrievably gone—it can not be recovered in the factory once the molds have "split it up." The molds are esthetically pretty to look upon, with their green and brown and yellow spores, but from the dealers' point of view they are *hideous*, and they *rob his pocket.*

Some months ago the Bureau sent out letters to the principal coconut-growing countries and a résumé of the replies may be of interest:

It appears that German Samoa was the first country to take decisive steps toward the standardization and improvement of the copra export. Within the last decade the copra industry there has been put upon a firm footing and there is probably no more up-to-date copra country in the world at present. The Government realized that it was necessary to not only have a proper drying apparatus, but the proper sort of coconuts as well, and accordingly regulations were prescribed obliging all copra dealers and agents to obtain from the Government a permit, which is non-transferable and which may be cancelled in case of non-compliance with the regulations. Furthermore, it is forbidden to *pick* the nuts—which means that only the dead-ripe nuts that have fallen from the trees are used for the copra, thus obviating one of the greatest faults of the Philippine copra industry—the use of the unripe nuts.

Some of the finest copra in the world comes from the Malabar coast in India and although prepared by native methods great care is exercised in choosing the nuts and in ripening them for a month or more on platforms; it is said that the nuts when thoroughly dried thus, have practically no "water" when opened, and the meat "comes out whole."

In Ceylon a great deal of the copra is now made over drying kilns somewhat like the tapahan of the Philippines but, of course, a large part is still sun-dried. The business is gradually coming into the hands of syndicates and large companies.

While French Cochin China produces only a small amount of copra the Government has encouraged the use of artificial dryers with good success. The Mayfarth dryer, made in Germany, is the most popular machine there; this is similar in style to the large fruit-dryers of California, the larger types handling about 5,000 nuts in twenty hours. By the way, it appears from experiments made recently by this Bureau that while copra can be thoroughly dried in fifteen hours from the breaking of the nuts, most of the artificial dryers now in use in other countries require about twenty hours.

Java probably ranks as the second greatest copra producing country of the world; the export statistics appear to need revising: while we find that some 72,000 tons were shipped in 1909, consular reports give 203,000 as the figure for 1910. Few artificial drying apparatus are used, however, and these are only of primitive types and local manufacture; instead of exposing the raw material to the fumes and smoke of the fuel pit, the better types of the Java dryers have interposed zinc sheets, and while there is, of course, danger of scorching the copra the creosote content must, of course, be greatly reduced. A few apparatus using hot air led direct through the copra trays or through flues beneath the floors and into iron ventilators are used.

Approximately the same conditions obtain in the Malay States as in Java; a great part of the copra is, of course, sun-dried; rather strangely, both the sun-dried and the kiln-dried copra are mixed and sold together on the market.

Siam, apparently through lack of attention to the great possibilities of the coconut industry, has allowed pests to practically ruin the business. Only some few hundreds of piculs are exported annually, yet even there the sun-dried, unsmoked article brings about ₱1 more per picul than the common kiln-dried.

In Mozambique both the smoky kiln and the sun methods are employed, but it is probable that the larger syndicates of Zambesia will soon adopt modern dryers. In most of the East African countries the copra is sun-dried.

With exception of the German possessions in the Pacific and the new British plantations in the Solomons, New Hebrides, and Papua, nearly all of the Pacific copra is sun-dried.

Outside of British Guiana, where a modern dryer has just been established, there is no copra made in Tropical America, the nuts being sold husked (but in the whole shell) in sacks.

Probably about one-third of the Philippine copra is sun-dried,

and all the rest is made either entirely on the tapahan, or else the two methods are combined. However, a large English rotary dryer has recently been purchased by the Moro Province government and several modern dryers will soon be established in the principal coconut districts of the Archipelago. Rumors have been heard of one or two "steam dryers" here during the past decade, but it is believed the apparatus exhibited by this Bureau at the First Philippine Exposition was the first steam-heat dryer to be offered the public in the East—or indeed in the world. This machine was devised by the writer and constructed by Mr. Z. K. Miller, machinery expert of this Bureau.

It is possible that some system of dry, hot air may be devised in the near future here, but to the producer who uses a cheap plant instead of a comparatively expensive boiler and oven, one grave danger will always be apparent—namely, the scorching of the raw product by overheating the flues supplying the hot air in the oven. The hot-air-flue method will, of course, appeal to the "small planter," but when the large estate owner looks ahead and calculates the extreme economy and safety obtainable by the steam-pipe-in-oven method, there can be but little question as to the proper system. The steam costs nothing; husks and shells are always on hand, rain or shine. Only a very slight pressure is required in the pipes and a temperature of 60° to 70° C. (140° to 160° F.) is sufficient to dry copra in fourteen to sixteen hours. At 75° C. (170° F.) there is, apparently, some danger of scorching or rather browning the material in the dryers, even if they are made (as they should be) of split bamboo or palm fiber inside the trays of iron or zinc frame-work. (A description of the Bureau's apparatus appeared in the REVIEW for April.) The only other process which has been considered as serviceable in the case of copra drying is the vacuum, but experiments made some time ago in the Philippine Bureau of Science by Mr. Herbert S. Walker demonstrated the impracticability of this method.

A word for and against the tapahan or direct fire (and smoke) kiln: *if* the copra maker would *cure* the nuts four to six weeks before opening them, and *if*, he would provide sliding zinc or iron sheets to keep under the raw material while the smoke from each fresh charge of fuel was being drawn off and up a flue, withdrawing the sheets as soon as a good bed of coals had been formed—there would be no strong reason for the small planter to change his system; but it is impossible to dry a charge of raw copra *evenly* and very difficult to dry it *thoroughly* by the

kiln method: one has only to examine a sack of the ordinary commercial article to discover charred, scorched, half-dried and occasionally almost fresh chunks all mixed together; the undried pieces rot first and the mold soon dampens and attacks the remainder.

Several steamship companies have been compelled to refuse copra as freight on their passenger boats; fresh unsmoked copra has a pleasant odor, but the common kind has not—not in the least.

Another point: the bacilli of tuberculosis have recently been found in "pure dairy butter" in one of the Eastern States of America. This indirectly, or perhaps rather directly, helps to put the housewife in the way of using coconut butter. The United States has at present only a few factories for coconut oil, suet, and butter and but very few popular brands of same; but there will soon spring up, especially on the Pacific coast and, as soon as the Panama Canal is opened, around the Gulf and on the Atlantic, numerous plants for handling Pacific and Oriental copras; New Orleans should become the center of the industry.

Another feature usually overlooked in discussing the future status of copra in the Old World was well put by the Financial Times a while ago:

> A point to notice is that the entire absence of animal matter from this article enables it to be used among Mohammedans, Jews, and Buddhists without offence to their religious beliefs; this is a very important matter, as is shown by the recent figures of consumption relating to the Far East, which demonstrates that vegetable butter is commencing to occupy a prominent position in the diet of the Asiatics.

Copra cake, or poonac, is one of the best feed stuffs for domestic animals that has ever appeared in the world's markets. It is such a staple in Europe that the copra dealers can well afford to encourage bulk shipments of the natural product instead of the pure oil—no matter how great the distance; by the same token it is only natural that the poonac and wholesale copra merchants should oppose the local manufacture of coconut oil. The time is not far distant, however, when many of the Philippine coconut planters will make their own oil, ship it through middlemen or direct, and utilize the cake in feeding pigs, cattle, and poultry; this will be the highest economy possible. Sending the oil off the estate does not abstract any plant-food elements therefrom—no more than the export of sugar does; but keeping the solid portion of the coconut kernel, feeding it to live stock, and using the manure around the young palms is saving the (rather small) leakage which occurs through copra shipment.

And the final word is: The world's markets are hungry for good copra. The demand will increase for the A 1 dry, unsmoked, non-musty staple, and the price will go up still more; but as soon as the first-class article is obtainable in fair quantities the price of the ordinary grades may fall considerably. Therefore it behooves the planter to get busy with modern methods so that the dealers can list him and favor him as a *clean-copra maker.*

COVER AND SECONDARY CROPS IN THE COCONUT PLANTATION.

By

O. W. Barrett

AND

P. J. Wester, *Horticulturist.*

Depending upon the soil, climatic conditions, the variety planted, and the care of the trees, coconuts do not begin to bear until in their fourth or seventh year from planting, and a full crop may not be expected until the trees are eight to ten years old. During this period the exchequer of the owner is subjected to a continual drain of "up keep" money if the land is devoted to coconuts alone. To decrease this expense and obtain some revenue from the land during the "adolescence" of the plantation should therefore be the aim of every grower of coconuts. Secondary, or "catch" crops, offer a solution of the difficulty; but even the handling of these calls for experience and careful attention, and, unfortunately, no fixed rules can be laid down to fit all plantations. Cover crops are very good indeed for the health and rapid development of the coconut grove, but they can not be expected to give a quick return *in cash* to the owner.

For instance, from the ordinary legume cover crops, such as Lyon bean, velvet bean, mani-manihan, cowpea ("sitao"), jack-bean, guar, pigeon pea ("cadyos"), ipil (*Lucæna glauca*) and madre de cacao, etc., but little actual revenue can be obtained, the benefit from planting these crops consisting in the shading and enrichment of the land and the conservation of moisture, thus hastening the development of the trees. Planters who are just beginning to use cover crops should remember that the advantages derived from them are: First, they keep the surface of the soil cool and moist through the hot, dry season,—a matter of very great importance to young coconuts; second, they store up nitrogen (condensed plant-food) in their roots; third, their

roots improve the soil physically; and fourth, they form a natural blanket on the soil surface, which prevents the rains washing away the highly valuable dead vegetable matter accumulated there: all these points are really of much greater import than the average planter appreciates. Almost anyone can make a profit growing coconuts but, other things being equal, the planter who employs cover crops is practically sure to win out away ahead of his neighbor who either follows the reprehensible *laisser faire* plan of letting the weeds and grass grow as they will or who tries at unnecessary expense to keep the interspaces clean.

The proper management of cover crops is an art in itself. (A circular or bulletin thereupon is contemplated by the writers.) Briefly, the running or trailing sorts may be broadcasted in the rainy season; but the drill system is usually the most economical as to seed and care of the plants until they get well started. The shrubby species, like the pigeon pea, ipil, madre de cacao, and even the semi-shrubby ones, like the guars, the crotalarias, and cassias—all these should be planted closely in hills in rows between the coconuts. The various vines may be rolled or cut with a disk harrow if they should get too luxuriant during the rainy season; if they climb upon the young palms too rampantly (a *good* fault, indeed) a boy with a stick may be sent along the rows once or twice a week, to poke them away. The shrubby and semi-shrubby kinds may be cut back occasionally in order to make them spread out at the bottom and shade the entire surface; a good sharp bolo in the hands of an ordinary laborer is all that is necessary for this beheading operation. The lopped-off material quickly turns into humus on the soil surface. If carefully managed there need be but very little danger from fires; some of the shallow-rooting species may die during prolonged drought and so become a menace, but the possibility of such an occurrence need never worry the planter in ordinary coconut regions.

Most of the legume covers can be used either as hay or as green forage or browse for goats, pigs, and even cattle. Some kinds are also important as human foods.

That the thrifty planter will need at least a few secondary crops goes without saying. Space forbids a full discussion of this interesting subject; but we beg to remind every coconut grower that it is his duty to raise a great part of the laborers' food as well as the animals' feed *on the plantation itself*. If due attention is paid to the ordinary principles of crop-rotation and management all or most of the following catch crops, grouped

according to their uses, can and should be raised on every coconut hacienda:

First-class foods.—Maize (in variety), sweet potatoes, beans (of many sorts), peanuts, pineapples, upland rices.

Second-class foods.—Cassava, bananas (of many kinds), papaya, roselle.

Third-class foods.—Millets, grain sorghums, dasheens and yautias (aristocratic relatives of the old "gabe"), síncamas (yambeans).

Forage plants.—Sorghums, maize, millets, and in the rainy season and in moist soils, Guinea grass, Rhodes grass, and possibly Natal and molasses grasses.

Generally speaking, none of these catch crops should be planted within 1.5 meters of the young coconuts; legumes, however, may be planted close up to the base of the stem.

Another matter which affects the status of the coconut estate is the raising of a good supply of vegetables and fruits in good variety; a home garden and home fruit orchard not only make life pleasanter and dietetically safer for the families of the superintendents of all grades but the surplus can always be readily disposed of either in the local markets or, in case of some sorts, among the laborers.

The following vegetables and fruits are recommended for general culture on all coconut lands:

First-class vegetables.—Tomatoes, eggplant, lettuce, beans, pechay (Chinese cabbage), radish.

Second-class vegetables.—Beets, carrots, okra, peppers, turnips.

First-class fruits.—Mangos, avocados, citrus fruits (orange, mandarin, lime, calamondin, lemon, pomelo), the anonas (custard-apple, sugarapple, soursop, cherimoya, and the new hybrids), carissa, carambola, and balimbing. Besides the general-purpose collection of fruits and vegetables every well-managed estate will have an experimental or trying-out collection; this not only breaks the hum-drum routine of estate work and adds a zest to life, but experiments (even negative ones) almost always *pay* in the long run—to say nothing of the fun.

HARVESTING NOTES FOR COCONUT PLANTERS.

By O. W. Barrett.

Don't pick, cut, or throw down the nuts if it can be avoided; they will fall when they are ready.

If "predial larceny" exists in the vicinity of the estate apply maximum penalties; the loss of a few nuts is not serious in itself but the principle is sadly bad, and the habit is quasi-contagious.

Don't use a bolo in cleaning out dead leaves and old fruit-stems in the coconut crowns.

The nuts in a cluster do not all ripen at the same time; those near the tip may be several weeks late.

Cure all nuts on raised platforms; not less than two nor more than eight weeks are required.

Husking is unnecessary; a machine is now on the market to open the whole nuts as fast as one man can feed them in; but a common broadaxe will also do the work—on a heavy chopping-block having a concavity in which the nut sits for the main blow.

The "water" from the breaking block, mixed with some dry feed may be given to pigs and cattle; it contains considerable nourishment; that from partially decayed nuts should not be used.

Decayed fresh meat and rancid or partly rotten copra are good only for the compost heap.

If the husks are piled up in windrows or long heaps near the breaking center, a watch must be kept for grubs of the uang; if they should appear in the old, half-rotten material the heaps should be used before the grubs attain full size; carefully managed, this husk compost heap serves as a *trap and bait combined.*

Light tramways, though expensive at the start, are valuable assets on an estate where draft animals and roads are difficult propositions.

Let the planter take good care of the young coconuts; when grown up *they* will take good care of *him.*

Tuba, or sap from the coconut flower bud, is richer in sugar

than most sugar cane juices; a mature tree will yield 0.1 kilo ($3\frac{1}{2}$ ounces) of crystallized sugar per day practically throughout the year—which means that nearly two tons could be expected per hectare. While tapping young trees is quite permissible (especially where the demand for tuba beverages is good) and probably a slightly lesser tax on the vitality of the plant than the ripening of fruit would be, the mature trees should be left in peace as *copra producers.*

Chemical fertilizers are undoubtedly good in most cases, but they are not necessary where organic manures and legumes are properly in evidence.

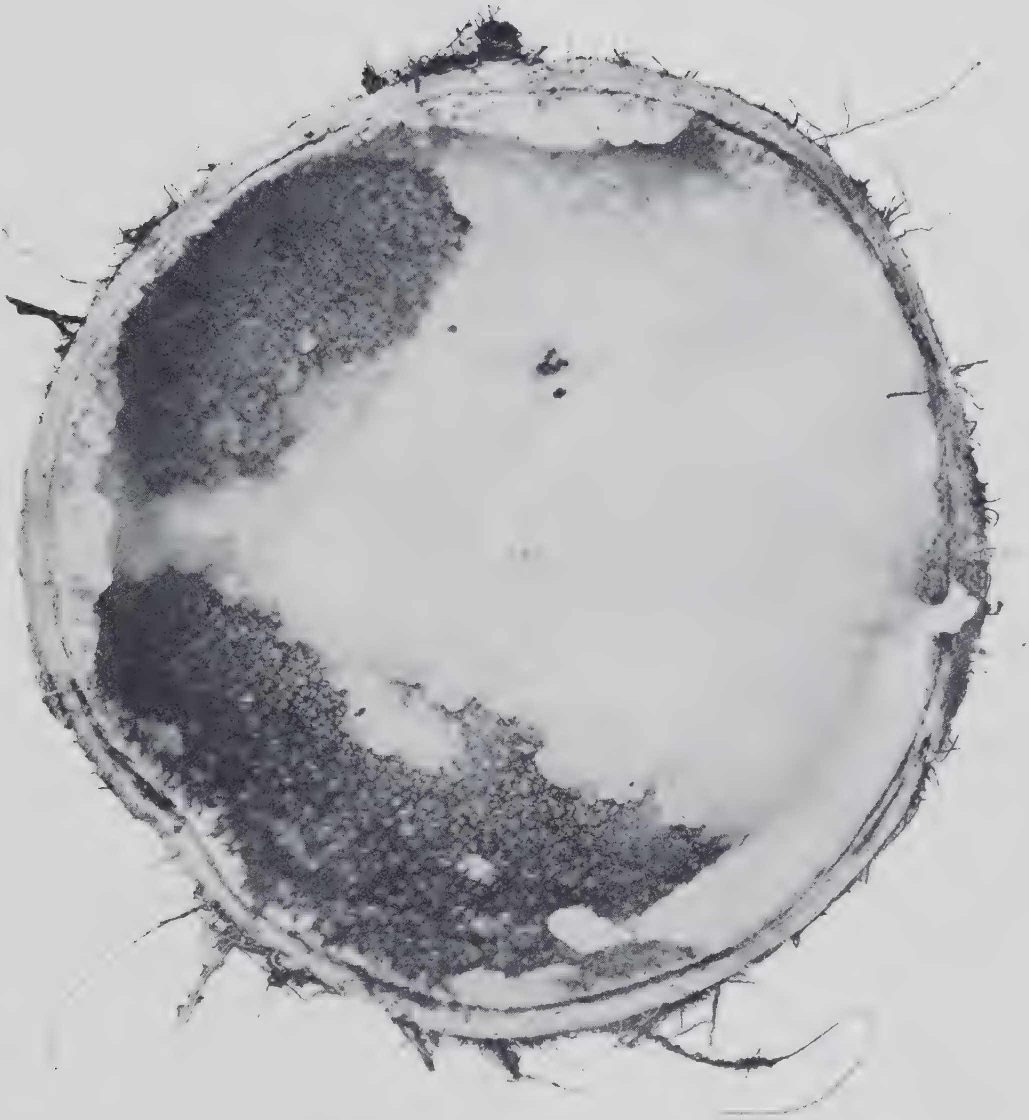


PLATE VI.—AN UNIDENTIFIED DISEASE OF RIPE COCONUTS.

(Photo by Bureau of Science.)

THE COIR INDUSTRY.

By M. M. SALEEBY, *Fiber Expert.*

Introduction.—Coir is the fiber obtained from the pericarp, or husk, of the coconut. It is the most important and most valuable, but not the only fiber produced by the coconut tree. The other fibers and fibrous materials produced by the tree, such as the leaflets and their ribs, the structural fiber of the leaf-stalks, and the sheaths surrounding the trunk at the bases of the leaves, have all been used since a very remote period for a wide variety of purposes by the natives of all the countries where the tree is grown. The use of coir, however, may not have been as ancient as that of the others, but at a later period it became so general that the value and importance of the fiber were very widely known; and in some countries, such as the Laccadives, we understand the natives used it long ago as a commodity of exchange.

The preparation of coir for local use by the natives has been practised, more or less, in almost every country where coconuts are cultivated. Its production and preparation for export purposes, however, is limited to only a few countries, chief among which are the southern half of the Indian Peninsula, especially along the coasts, Ceylon, the Laccadives, and the Malay Peninsula. In the above countries coir is exported either in the raw state, in yarns, or in ropes or some other manufactured form.

Until the year 1851 and for a short period afterwards, the uses made of coir were restricted to the manufacture of coarse ropes and mattings and, a little later, to the stuffing of cushions and mattresses. Since then, the introduction of ingeniously constructed machinery has considerably increased the uses of the fiber by so handling and preparing it as to render it sufficiently fine for the loom and for other weaving and cordage machinery. Thus we now see rugs and mats of different textures and devices, ropes and cables of different sizes and types, brushes, brooms, hammocks, and a variety of other common articles, all of which are made entirely from coir.

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Picking of the nuts.—The stage of ripeness at which the nuts should be picked for separating the coir is a question around which has centered a great deal of discussion. Several tests have been made, which proved that the nuts that are between nine and ten months old, or before they are quite mature, give a finer, whiter, and more elastic fiber than when they are thoroughly ripe. In ripe nuts the husks become brown and hard and the fiber coarse and stiff, necessitating a longer period for retting it in water. As a result of too long retting, the fiber is bound to depreciate both in color and in strength, thus showing at a glance that the production of the high grades of coir will seriously interfere with the copra crop which is far more valuable and more important than the former. The thoroughly ripe nuts produce more, and a better grade of copra than the less ripe ones. This fact is so well known now that some authorities on the subject have even gone so far as to recommend piling the ripe nuts in heaps on the field or on platforms for a few days or weeks prior to opening them, believing that this will improve the quality of the copra and also increase its oil content. The above fact will help to explain why the progress of the coir industry has not kept pace with that of the copra industry and it also constitutes one of the chief drawbacks to a more general practice of coir production.

Separation of the fiber.—Up to a comparatively recent period, the separation of coir from the husks was carried on by retting in water. Several attempts have been recently made to invent machinery to separate the fiber; and while some have been, in a measure, successful, yet most of the fiber is still being separated by the old method.

The retting method is used all over the coir-producing countries, the process being practically the same in all of them.

In the British East Indies, including Ceylon and the Laccadives, and in the Malay Peninsula, the husks are removed and piled in holes or pits dug in the sand along the sea beach and kept under the influence of salt water for a period varying from eight to twelve months. During this period the husks are kept from floating away by placing large stones over them. At the end of this period the husks are taken out and beaten with mallets and afterwards spread in the sun to dry. After drying, the fiber can be easily separated from the extraneous matter by rubbing. In localities which are not accessible to a body of salt water the husks are soaked in pits of fresh water, but in this case the water becomes foul and the fiber is both

discolored and weakened. Fresh water tanks from which the water can be changed as often as required and in which the water can be occasionally heated by steam in order to reduce the period of retting are the latest and most satisfactory improvements on the native method described above. Steeping in water, in any event, is bound to leave its effects on the fiber by discoloring and weakening it, besides being a long and tedious method that can be practised only in countries where labor is extremely cheap.

In Java coir is produced on a small scale in the central southern district where the fiber is used locally for making brushes, ropes, mats, etc. The method used there is as follows: The useless surface layer of the husks is scraped off in order to expose the cellular tissue to the disintegrating action of water, after which the husks are soaked thoroughly in water for several days. The husks are then taken out of the water and are beaten with a round wooden mallet while they are wet. This operation of soaking and beating is repeated as often as necessary until the fiber is completely separated from the pulp. Usually four or five repetitions prove sufficient for that purpose.

In the Philippines even less coir is produced than in Java. Its quality is also inferior to that of the latter, and is used only for calking boats and ships as a substitute for oakum, for which purpose it is highly suitable.

Several machines of different sizes and capacities have recently been invented to separate the coir from the husks. General opinion as to the practicability of using such machines seems to be divided. Some claim that the cost of transporting and dividing the husks together with the cost of handling them during the several processes through which they must pass from one apparatus into another entails too much expense, and cite in defense of their arguments the several attempts that have been made and ended in failure. Others seem to believe that the use of machines has in many cases demonstrated their suitability and practicability, and ascribe the failure of the several attempts that have been made to mismanagement from a business point of view.

One of the best coir machines is that built by Messrs. Larmouth & Co., Manchester, England, which the writer witnessed in operation during the Surabaya Fiber Exposition. This consisted of a series of machines run by one power and designed to handle the fiber in its different stages of preparation, from crushing the partially soaked husks to the final processes of

weaving coir mattings and making cordage. A brief description of this compound machine will serve to explain the general principle in which all coir machines, more or less, agree. The different parts which compose this machine are:

1. *Crusher,* which takes in one-fourth part of a husk at a time and loosens the fiber from the binding cellular tissue.

2. *First scutch wheel,* against which are held, one at a time, the pieces of husk that have passed through the crusher. The two halves of each piece of husk are cleaned separately, each half being fed in two to four times.

3. *Second scutch wheel,* which is provided with finer teeth than the preceding one and through which the pieces of husk that come out of the former should be similarly fed in for further cleaning.

4. *First card,* which is designed to clean and straighten the fiber turned out by the second scutch wheel.

5. After carding, the fiber passes through a *cleaning machine* consisting of a revolving drum which shakes off all dust and other impurities.

6. A *second card* is again used, through which the fiber is made finer and becomes ready for its final treatment.

7. *Spinning and weaving* and other machinery, which are used to make from the cleaned fiber the articles it is intended for.

Yield and value.—The yield of coir depends upon the variety of nuts produced, the fertility of the soil, and the stage of ripeness at which the nuts are picked. According to Robinson, the proximity of the trees to the sea-coast also affects the yield of coir. These are, in all probability, responsible for the several widely divergent estimates given by several writers. Another cause that may have led to the difference in the estimates of the yield of coir is the method of computing the yield from few nuts and making that the basis upon which to calculate the produce of a certain number of trees or a certain area planted with them, which method has been lately disapproved as being impracticable and often inaccurate.

Basing my figures upon the most conservative estimates, it may be safe to state that every thousand nuts will produce on an average 65 kilos of yarn and 10 kilos of brush fiber. At this estimate a hectare of land containing 110 trees and producing an average of 50 nuts a tree per year will produce about 385 kilos of yarn and 55 kilos of brush fiber, valued at approximately ₱60, which is practically 20 per cent of the value of the copra crop produced from the same number of trees.

To give a general idea of the prices paid for coir at the present

time, I quote below an extract from the monthly circular of Messrs. Ide & Christie, dated London, February 15, 1912. The prices are estimated per ton, and are roughly reduced to Philippine currency:

Coir yarn.

	Per ton.
Common to good Cochin roping dholls	₱85–₱140
Common to good Cochin roping bales	100– 150
Common to fair Cochin weaving bales	180– 220
Fair to good Cochin weaving bales	230– 260
Good to extra Cochin weaving bales	270– 320
Common to fair Ceylon dholls and ballots	160– 190
Fair to good Ceylon ballots and bales	210– 230
Good to extra Ceylon ballots	240– 280

Coir fiber.

Cochin, common	₱90–₱150
Cochin, fair	170– 190
Cochin, good	200– 220
Ceylon, short to fair	100– 105
Ceylon, clean long	110– 140

Coir rope.

4½ to 6 inch	₱130–₱180
2½ to 3½ inch	130– 200
1½ to 2½ inch	130– 200

Description of the fiber.—Dodge describes the fiber as follows:

Cor fiber appears in the form of large, stiff, and very elastic filaments, each individual of which is round, smooth, very clean, resembling horsehair. It possesses a remarkable tenacity and curls easily. Its color is a cinnamon brown. These filaments are bundles of fibers, which when treated with the alkaline bath and ground in a mortar, are with difficulty separated by the needless for microscopic examination.

The individual fibers are short and stiff, their walls very thick, notwithstanding which this thickness does not equal the size of the interior canal. The surface does not appear smooth; it is often sinuous and the profile appears dentated. The diameter is not very regular. The points terminate suddenly and are not sharp. The walls appear broken in places as if they were pierced with fibers, corresponding with the fissures of the sections.

A comparative test of the strength and elasticity of a coir rope as compared with those made from *Hibiscus cannabinus* and *Sansevieria zeylanica* showed, according to Doctor Wright, that the first broke under a strain of 224 pounds (103 kilos), the second under 190 pounds (87.4 kilos), and the third under 316 pounds (145.3 kilos). Other tests made at the office of the Marine Board of Calcutta with most of the cordage fibers of commerce showed that coir ranked No. 12 in strength and No. 1 in elasticity. This latter quality makes coir particularly desirable in all cases where sudden strains are anticipated such

as for moorings for ships during rough weather and other similar objects.

Conclusion.—By a careful review of the facts mentioned in this paper and pertaining to the methods of preparing coir and to its uses, value, and yield, it appears plainly that the only hope for establishing the coir industry here in the Philippines lies wholly in the introduction of suitable machinery designed, not only to separate the fiber from the husks, but also to manufacture it into the various articles for which it is used. Even then, it can not with certainty be stated that satisfactory results will be assured, as such machines require a large outlay of capital and can only be operated profitably in large estates or in localities where the trees are grown in large numbers sufficiently concentrated so as to reduce to a minimum the expense of transporting the immense number of husks. Such localities are further limited when we consider the fact that the production of coir with, or without the use of machinery is bound to conflict, to a more or less serious extent, with the copra industry. This may come about in two ways: First, in many instances the husks are badly needed for fuel used in drying the copra in the localities where there is no pronounced dry season; and second, the production of good grades of coir affects the yield and quality of the copra crop, owing to the alleged belief that the stage of ripeness of the nuts for the production of the best coir does not correspond with that at which the production of the best copra is obtained.

The retting and hand methods used in the various countries where coir is produced are so slow, tedious, and inadequate to the requirements of a successful industry, that it is useless to attempt to encourage their practice here. The use of small machines designed only to separate the fiber from the husk has not, as yet, come into general use, and the results of the various tests have not yet definitely decided their efficiency and practicability.

The discussion of the coir industry given in this paper is not intended to discourage any judicial attempts directed towards establishing this industry here in the Philippines, but rather to point out the principal difficulties that must be considered and overcome before any such attempt can come to any satisfactory realization. In making such an attempt, or for further information on any phase of the industry, the Bureau of Agriculture will gladly give all the help and advice that lie within its scope of action.

COCONUT RECIPES.

It is greatly to be regretted that in the Philippines the use of the coconut as a food is limited to two or three dishes; in fact it scarcely enters at all into the domestic economy of either Americans or Europeans, although the Filipino races do consume a considerable quantity of coconut "meat" mixed with rice or made into "dulces" with sugar. In other countries, however, like India and Spanish America, a considerable number of fancy dishes are made from the various parts and kinds of coconut. Several of these dishes would be a valuable addition to Philippine cookery, and the following recipes[1] are offered with the hope that they will be given a trial by all families interested in increasing the list of good food and dishes for the home table:

Coconut cream.—This may be used with a variety of dishes in the same way as dairy cream; added to gelatine, bread, corn starch, or rice puddings it imparts a delicious flavor without the objectionable feature of grated "meat": there is nothing better to serve with fruit, either fresh or preserved, than a few spoonfuls of this cream poured over the dish just before serving.

To prepare this cream, grate the "dry," or ripe, coconut and to the grated meal add enough boiling water to cover; stir with a tablespoon for one minute and then squeeze through a strainer cloth. The semi-fluid cream has not only the true coconut flavor, but it is both a rich and easily digested food and a delightful flavoring extract. Another method produces a slightly different article: to one grated coconut add three-fourths of a liter of boiling water; let this stand until cold, then skim off the cream which will have risen to the surface.

Ambrosia.—Add grated coconut pulp to shredded orange, pineapple, and sliced bananas. Mix thoroughly and sweeten with confectioner's sugar; this delicious dish may be decorated with maraschino cherries.

Coconut ice cream.—To the cream from six small or four

[1] From Mrs. O. W. Barrett, Manila, P. I.

large, ripe nuts, add an equal quantity of "natural" tinned milk; sweeten to taste, and add vanilla or other flavoring.

Coconut ice.—Mince the jelly of six unripe coconuts and add one liter of the water therefrom; sweeten to taste; no flavoring is required as nothing can improve the taste of this sherbet.

Coconut rice.—To the grated meat of one coconut add two cups of hot water; squeeze this in a strainer cloth and add sufficient water to make four cups of liquid; add four tablespoons of sugar, a spoonful of ginger, and two cups of rice; cook in a double boiler for nearly one hour. Serve for desert. (In Spanish America ginger is almost always added to coconut dishes; it promotes digestion.)

"Bien-me-sabe," or coconut savory.—This is the justly famous Spanish dessert dish of the West Indies. To the grated meat of one large, ripe coconut add one cup of hot water and squeeze through the strainer until all the "milk" is extracted; to this creamy liquor add the beaten yolks of four eggs and four tablespoons of white sugar. Heat slowly, stirring well until a thin custard-like coating forms upon the spoon. Remove from the stove and when nearly cold pour over small slices of sponge cake. Finally spread over the dish a layer of egg whites thoroughly beaten and sweetened. Serve as cold as possible.

"Polvo de amor," or love powder.—This is also one of the commonest desert dishes in Spanish America and is worthy of much greater popularity; it often accompanies the preceeding. To the grated meat left after the extraction of the cream for the previous dish, add several tablespoons of moist brown sugar and toast slowly in a deep iron skillet, stirring constantly until the coconut assumes a light brown color. Serve hot. This dish keeps well for several days, but it should be placed in the oven a few moments each time just before serving.

Coconut and tapioca pudding.—Mix one cup of "minute tapioca" with four tablespoons of grated coconut "meat," the yolks of four eggs well beaten, one cup of white sugar and one liter of "natural" tinned or dairy milk. Bake for one-half hour and add meringue made of the whites of four eggs and three tablespoons of sugar.

Coconut soup.—To common clear beef-stock thickened with barley or corn starch, add the "cream" of one coconut and one teaspoon of curry powder (previously moistened with cold water); this must not boil after the coconut is added.

Coconut candy.—Cook one-half kilo of brown sugar with one-half cup of hot water until it hardens when dropped into cold

water. Add the grated "meat" of one coconut and one-half teaspoon of ground ginger, one-fourth teaspoon of ground cinnamon, and one teaspoon of vanilla extract. Cook again until the mixture will harden in cold water; pour into buttered tin to cool. Cut into squares.

Filling for coconut pie.—To the grated meat of one ripe coconut add one-fourth kilo of white sugar well beaten with four eggs; flavor with vanilla or with lime or lemon juice.

COPRA MACHINERY.

What becomes of the nearly 600,000 tons of copra when it arrives at the oil factory? How is the nearly 200,000 tons of poonac made? How is coconut oil to the figure of 400,000 tons per year expressed? These questions are of secondary importance, but nevertheless of real interest to the copra producer in the Philippines; the following extract from an article on the "Coconut Palm and its Products," by Thomas Barraclough, is taken from the British Trade Journal:

The assortment of machines required for the treatment of copra, and the extraction of oil from it, varies very much according to the size of the installation, the quality and condition of the raw materials, the local and other circumstances under which they have to work. In my short description of the processes copra undergoes and the machines employed, I have assumed an installation large enough to be able to work under the most favorable circumstances, namely, to produce the largest quantity and the best quality of oil possible from clean, well dried copra.

The hydraulic presses most suitable for the extraction of the oil can not be fully described in the limited space at my disposal, but the following general information may be found interesting and useful. As already stated, twice pressing is considered a necessity by men of experience in trade. The first pressing extracts from the copra meal in its natural state (not hot) the best quality of oil, and for this operation hydraulic presses, each having a ram 12 inches in diameter capable of working up to a maximum pressure of two tons per square inch, gross pressure 226 tons, are in favor. Each press produces by each pressing 14 or 16 cakes, the finished size of which may vary from 12 to 14 inches in width, and from 30 to 32 inches in length.

The second pressing is effected by means of hydraulic presses, each having a ram 18–½ or 19 inches in diameter, capable of working up to 3 tons pressure per square inch, the gross pressure being respectively 800 to 850 tons. This enormous pressure is necessary to ensure the extraction of the maximum desired quantity of oil, and also to ensure the production of cakes of sufficient hardness. The number of these cakes may vary from 16 to 18 per pressing. These presses are made of the best quality of materials, steel being largely employed. An enormous margin of strength is wisely allowed for in the dimensions of the main parts, so as to reduce to a minimum the possibility of a breakdown. Each press bottom has a large receptacle for receiving the oil as produced, thus rendering a loss of oil by leakage impossible.

In an oil factory where four or more presses are at work high and low

pressure accumulators are used with great advantage, in preference to using a number of hydraulic pumps. Constant and uniform pressure is secured, and no undue pressure is possible. The accumulator acts as a positive safety valve to the hydraulic pumps supplying the necessary pressures. The employment of fewer hydraulic pumps causes a saving in gearing and also in driving power (about 50 per cent).

In oil works using sun-dried copra as raw material, containing dirt and a variety of extraneous matters, a magnetic separator is usually installed for automatically separating from the copra bits of iron, nails, etc., so often found in this class of copra. It is fed on to the shaking feed-tray of the machine, which equalizes the quantity fed and causes the bits of iron to sink to the bottom of the stream of copra in such a manner that the non-magnetic material (copra) falls down in front of the machine, the bits of iron being carried round the magnetised cylinder and dropped at the back of the machine by an automatic breaking of the current. The machine can also be fitted with a screen for automatically separating from the copra fine extraneous matters, such as sand, dust, chips, etc., a very valuable addition under certain circumstances. The machine is able to treat, according to its size, from half to one and a half tons of copra per hour; it is a very practical labour-saving machine, and the elimination of iron, etc., prevents damage to the machines through which the copra has to pass before being pressed.

The first preparing machine is the disintegrator, largely employed in modern oil factories for disintegrating and reducing the pieces of copra, so as to fit them for further treatment. The copra is fed in at the periphery of the disintegrating chamber of the machine, and falls on to the extremities of beaters attached to a disc revolving at great speed, thus quickly effecting the disintegration. Many important improvements have recently been introduced in the working parts of the machine, which is constructed in five different sizes with capacity for treating from 5 to 45 hundredweight of copra per hour. The disintegrated copra next undergoes a fine grinding process, with the object of preparing it fully for the pressing operation. Experience has clearly proved the advantage arising from treating it when fine ground, such as a freer flow of the oil when under pressure, and a greater facility for obtaining cakes of equal density.

The special grinding machine has two pairs of rollers; the upper pair has a concave plate between which and the rollers the copra passes to the lower pair of fine-toothed rollers; the grinding takes place between the rollers; clogging is impossible, as the rollers are constructed to clean each other. The machine has a capacity for grinding from 12 to 40 hundredweight per hour, according to the size.

In this condition the ground copra, called "meal," is then fed into a circular so-called kettle, although no heat is used. It is furnished with a stirring apparatus, delivery plate, and apparatus for measuring the meal in quantities each sufficient to form one cake, the meal being subject to a slight preliminary moulding with pressure, in a moulding and compressing machine to which the kettle is attached, the object being to form and prepare the cakes for their first pressure.

After the cakes have been pressed and the oil extracted to the extent desired, they are removed from the presses in order to be broken up and re-ground, so that the material of which they are composed can be suitably prepared for the second pressing operation.

This is effected by passing them into a special cake-breaking and grinding machine, which reduces them in one operation to a fine meal. This machine is very powerful and effective, capable of treating from one to six tons of copra cake per hour, according to the size of the machine. The fine meal is then fed into a kettle similar to the one already described, but with the addition of a steam spraying apparatus, by which the meal is heated to a temperature of about 180° Fahr., and the necessary moisture is added. The heat renders possible the extraction of the maximum desired amount of oil; the moisture causes the meal to adhere together with sufficient tenacity to form a cake. The meal then passes direct to a moulding machine, which measures the quantity of heated meal delivered from the kettle to form one cake at a time. The machine simultaneously imparts a slight preliminary pressure (steam or hydraulic) so as to render each cake fit for placing in the second presses to undergo the final pressing. The number of cakes produced per hour varies according to circumstances, but one kettle, with moulding and compressing apparatus, will supply sufficient cake for about four presses; the kettle and the moulding and compressing machine are combined together for automatic working, with the great advantage of saving of labor and increased production.

The oil resulting from the second pressure flows into a receptacle in the bottom of each press, and is then forced by means of an oil pump into special oil-collecting tanks, each fitted with three divisions. The cakes resulting from the second pressur are placed in racks for cooling purposes, and after they have been pared they are taken to the cake house. The paring of the edges of the cakes causes them to be all exactly the same size. The parings are utilized by being re-ground and mixed with the meal for second pressing. In some oil factories the cakes produced are for cattle-feeding purposes, and must contain sufficient oil, say about 5 per cent. to render them valuable as cattle food. In other works the cakes, according to circumstances, are sold as valuable manure, and not more than 1 per cent of oil is left in them. . . . . .

Leading firms who make a speciality of the construction of oil machinery, having carefully studied the extremely varied requirements of oil producers in distant lands, have laid themselves out to supply oil-extracting plants of every size and description, adapted for efficient practical work, under the most varied circumstances. The sizes of the installations may vary from a very small one capable of treating, say, 10 hundredweight of copra per day of eleven hours, up to the very largest size that may be required, say, for treating hundreds of tons of copra per week of 132 hours and all intermediate sizes.

In the smaller sizes the machinery employed cannot be of maximum efficiency, but one may truly say that, considering the smallness of the installation, its small cost, the quality and the quantity obtained, the cost of production is moderate, and the process simple and easily worked, even in outlying districts, with considerable profit; in addition to which the cakes formed from the non-oleaginous part of the copra cost nothing, but are of considerable value locally.

PLATE I.—CHERIMOYA BUDDED ON MAMON STOCK; ONE SEASON'S GROWTH (OVER 250 CENTIMETERS).

THE PHILIPPINE
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VOL. V JUNE, 1912 No. 6

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

THE PHILIPPINE AGRICULTURAL REVIEW TO BE PLACED ON A SUBSCRIPTION BASIS.

On July 1, 1912, the PHILIPPINE AGRICULTURAL REVIEW will be placed on a subscription basis. The principal reasons which have resulted in this action are as follows:

The REVIEW has been published and distributed free of charge

throughout the Philippine Islands for a period of four and one-half years. This publication is now well known in all parts of the Archipelago, and the demand for it has far outgrown the supply of copies which it is practicable to issue for free distribution. This demand is constantly increasing, with the result that the majority of new applicants, many of whom would be glad to pay a nominal subscription price for the magazine, have to be refused. As it is impracticable to obtain specific and reliable data as to the status and qualifications of all applicants, many persons are now refused the REVIEW who no doubt could use it to good advantage, while the names of many others who do not use it to good advantage remain on the mailing list. It is believed that practically all persons who really desire to receive the REVIEW for their own personal use will appreciate the existing situation, and will be willing to pay a nominal subscription price for this publication.

A subscription price of two pesos (₱2) per year will be charged subscribers in the Philippine Islands and the United States. As this price will only partially cover the cost of the publication, the primary object of placing a subscription price on the REVIEW is to eliminate "dead material" from the mailing list and to furnish all applicants an opportunity to receive the magazine.

For the benefit of such persons as may be unable to subscribe for the REVIEW, one free copy will be sent to each municipality in the Islands, in the care of the municipal president. There will also be a limited free distribution to a selected list of Government officials, libraries, newspapers, and similar agencies that are in a position to disseminate agricultural information among the people.

There is inclosed in this number of the REVIEW a notice setting forth the conditions under which this publication will hereafter be issued. Inasmuch as all names on the mailing list that are not included under "free distribution" will be dropped on July 1, 1912, it is earnestly requested that persons desiring to receive the REVIEW on and after the above-mentioned date will forward their subscriptions promptly to the Director of Agriculture.

BUREAU OF AGRICULTURE CIRCULARS.

CIRCULAR No. 13.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

MANILA, *December 20, 1911.*

RATS.

By D. B. MACKIE, *Agricultural Inspector.*

As a pest in corn, camote, and cane fields, and in coconut plantations, rats constitute one of the most serious crop pests of the present day in the Philippine Archipelago. In certain cases locusts appear to do more damage locally and in other cases certain insects, wild pigs, deer, etc., seem to cause more losses to agriculturists, but it must be remembered in this connection that rats are more difficult to observe and more insiduous in their operations. Furthermore, the rat pest is prevalent throughout the Philippines, no district, except possibly some of the forest areas, being free from its depredations.

The greater part of the damage done by rats is caused by one species, the so-called Brown Rat. This species has now become cosmopolitan and readily adapts itself to almost any conditions of life that it may meet, reproducing rapidly wherever it finds a constant food supply. Two or three other species of rats exist in sufficient numbers in some few localities to require the attention of the planter.

METHODS OF DESTRUCTION.

The following recommendations may be gathered under three heads, namely, traps, poisons, and fumigation:

Traps.—The use of traps is recommended in all situations where the habits of the animals can be conveniently observed; for instance, in plantations where their paths or burrows are in evidence, or where their depredations in camote fields, vegetable gardens, grain storehouses, etc., can be plainly seen.

The type of trap which immediately kills a single animal is recommended for ordinary use. Several forms of a very cheap wire spring trap are now on the market. Deadfalls, or traps to crush one or several rats at once, may be used to good advantage in bodegas.

Cage, or box traps.—These have the advantage of being able to catch a number of rats at once but the animals soon get so suspicious and wary that they will not enter cages, even when the latter are smoked or passed through the fire to remove the odor.

A drop of oil of anise rubbed over the metal of the trap in many cases serves to lure the rats to the bait.

The bait for spring traps should be some easily prepared substance like boiled rice, cooked camote, grated coconut, etc. The bait should be prepared in small quantities at frequent intervals rather than in large quantities. A little of the bait should be dropped in the neighborhood of the trap to entice the animals thereto and accustom them to the appearance of the bait at that place. The kind of food used in preparing the bait should be unlike that of the regular food of the rats in that locality; for instance, coconut should be used in camote or corn fields, while boiled rice or camotes make a good bait for coconut plantations.

Both cage and spring traps should be passed through a fire (of grass or brush) after each killing.

Poisons.—Arsenic is probably the safest substance to use in preparing poisoned bait for rats in the Philippines; this poison has no taste and it is merely a question of accustoming the animals to the bait, or to a certain kind of food in a certain place before adding the poison thereto.

The bait (boiled rice, camote, or grated coconut, or mixture of coconut with either of the other two) should contain about 25 per cent, by weight, of white arsenic, and the poison and food substances should be thoroughly mixed together by stirring with a stick. Care should be taken to prevent the arsenic from getting into cuts or scratches in the skin of the hands. Strychnine, barium carbonate, potassium cyanide, corrosive sublimate, or phosphorus, can also be used effectively against the rat pest; these poisons require considerable skill in handling, however, and they are also more dangerous.

Fumigation.—In cane fields, or in land where rats have been established for some time so that burrows, nests, and runways are plainly in evidence, this method can be used to good advantage if certain principles are borne in mind.

Carbon bisulphide.—This fumigant is especially recommended for ordinary cases since its application is exceedingly simple. The best method is to apply the liquid (which should be kept in well corked bottles) to a ball of cotton, or some loose fibrous substance which can be thrust into the mouth of the burrow, and then immediately covered up with earth. Care must be taken, of course, to see that all burrows opening from the one which is being fumigated are closed so that the animals can not escape from the fumes, which will rapidly fill the entire space.

Sulphur-arsenic.—In certain cases the gas generated by burning three parts of sulphur to one part of arsenic in a closed receptacle—for instance such an apparatus as is used in forcing sulphur-arsenic fumes into termite galleries—can be introduced into the burrows in the earth, or into holes in walls or floors of bodegas. All the galleries possible should be stopped except the one for introducing the fumes and another at which the animals can escape—preferably into a box or some sort of a trap for immediate killing.

GENERAL METHODS.

Coconut trees can be protected from attacks of this pest by nailing a strip of tin around the trunk at a height of about 2 meters from the ground; the upper edge of this strip should be turned outward on the upper side of the trunk if the tree does not stand vertical. On account of the rapidity with which ordinary tin, such as that from kerosene cans, becomes oxidized, especially in the vicinity of the sea, this method is not recommended except for small plantations located in badly infested districts.

Rice fields may sometimes be freed from rats by raising the water therein for a few hours to an unusual height; of course, the rats must be killed by stationing laborers along the dikes at the margins of the field. The various commercial rat poisons and virus for producing contagious diseases in rats are not recommended for ordinary use.

CONCLUSION.

By careful attention, with both traps and poisons, the rat pest in any ordinary case can be readily checked, if not entirely exterminated. Coöperation is, of course, practically necessary in any district of considerable extent, since, if the rats are

allowed to breed in one plantation, no permanent relief can be had in the adjacent plantations.

Special cases of damage by this pest which can not be controlled by the methods given above should be reported at once to the Director of Agriculture, Manila, P. I.

O. W. BARRETT,
Chief, Division of Experiment Stations.

Approved:
F. W. TAYLOR, *Director of Agriculture.*

CIRCULAR No. 14.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

MANILA, *December 27, 1911.*

CORN-BLADE FODDER.

By C. M. CONNER, *Assistant Director.*

Though it is true that only a small amount of corn is produced in these Islands, a great deal of the nutritive value of that which is produced is lost by leaving the stalks and leaves to rot in the field. In countries where rainfall is not so frequent as here, the entire stalk is utilized; to do this, however, it is necessary to leave the corn shocked in the field for a period of at least sixty days after cutting, in order that it may become thoroughly dry. This is not possible in a country where there is frequent rainfall, and the most that can be done is to utilize the leaves, which is entirely feasible in the majority of cases.

The following instructions are given for the benefit of those who may wish to plant corn and use the leaves for fodder:

Fairly rich land should be selected and prepared by plowing thoroughly at least 5 inches (127 millimeters) deep. The soil should then be pulverized with a harrow or some similar implement. Rows should be laid off about 3 feet (91 centimeters) apart and corn planted at least 3 feet (91 centimeters) apart in the row. It would save some labor if the field were laid off in rows 3 feet (91 centimeters) apart each way and the corn planted in check so it could be plowed in either direction, thus saving considerable labor and hand weeding.

On fairly rich ground at least three or four grains of corn should be planted in each hill. As soon as the plants are 4

inches (1 decimeter) high the hill should be thinned, by pulling up the surplus stalks, to two stalks in each hill. On poor soil leave only one stalk.

Cultivate at least three or four times during the season with a cultivator which will turn the ground at least 2 or 3 inches (5 or 7 centimeters) deep, keeping down all weeds and grass.

When the silks of the ear of corn have dried and become black the ear of corn will be hard; that is, no milk can be pressed out of the grains by mashing them. As soon as the ears reach this stage the fodder is ready for pulling. It will not materially reduce the yield of corn by pulling the blades at this time. The loss is only a very small fraction of what it would be if the leaves were allowed to remain on the stalk.

The fodder is pulled by a downward stroke of the hands on either side of the stalk, grasping the leaves as the hand passes down. Only green blades should be pulled. As soon as both hands are full tie the leaves together into a bundle, using one or two blades for this purpose. Open the bundle in the center and hang it over the ear which remains on the stalk; the bundle being tied near the butt end will hang in this position even in strong winds. Allow it to cure in the sun for at least two days, or until the blades are dry enough to crumble up when mashed in the hand. As soon as the small bundles are sufficiently dry they should be collected, while still sufficiently moist from the dew to prevent breaking, into larger bundles about 6 inches (15 centimeters) in diameter. These large bundles may be tied with blades of fodder as in the case of the smaller bundles. The fodder should then be collected together in some convenient place and stacked. The stack should be raised off the ground by using either rice straw or bamboo to keep moisture from spoiling the blades near the bottom. It is very convenient to place a bamboo pole about 8 feet (2.44 meters) long in the ground as a center, making the diameter of the stack nearly twice the length of the blades, always placing the butt end of the bundles out, but always keeping the center of the stack higher than the outside. This enables the thick part of the leaves to cure more thoroughly. Make the stack about 8 feet (2.44 meters) high, placing a covering of some kind over it in order to keep off the rain. This covering may be of straw, grass, or leaves of any kind. After the fodder has remained in the stack about four weeks it will be thoroughly cured out and be perfectly green and bright. When cured in this manner it can be stored under sheds in bulk and will keep quite a

FIG. 1.—Method of Stripping Leaves for Corn-blade Fodder and Hanging Bundle on Stalk to Dry.

long time. It can then be pressed into bales for the purpose of shipping. Corn blades saved in this manner make a hay which is equal to the best hay on the market.

In pulling the blades from the stalk no dead blades should be pulled, only fresh, green blades should be used in making fodder. The dead blades that are on the stalk at the time the leaves are pulled have no feeding value.

Approved:

F. W. TAYLOR, *Director of Agriculture.*

ANONACEOUS FRUITS AND THEIR PROPAGATION.

By P. J. WESTER, *Horticulturist.*

GENERAL REMARKS.

The genus *Anona* contains, according to Kew Index, 125 species, of which only four are cultivated to any extent for their fruits: The cherimoya (*Anona cherimolia* Miller); the sugarapple (*Anona squamosa* L.); the soursop (*Anona muricata* L.); and the custardapple (*Anona reticulata* L.). These are commonly esteemed in the order enumerated, though some writers prefer the fruits of the sugarapple to those of its congener.

There are, however, in this genus as well as in the closely related genera *Rollinia* and *Uvaria*, many species that produce edible fruits, some of which, even in their wild state, are said to be of very good quality. Among these may be mentioned the biriba (*Rollinia orthopetala* A. D. C.), the fruit of which, according to Martius, attains the size of an infant's head, and which is by one recent collector pronounced the finest anonaceous fruit in tropical America; the marolo (*Anona crassiflora* Mart.), indigenous to Brazil; the equinox (*Anona paludosa* Aubl.), a native of Guiana; and *Rollinia silvatica* Mart., found in Brazil. Altogether these genera contain over twenty species that are known to produce edible fruits and it is probable that this list may be extended. Many other species may doubtless be utilized as stocks or for breeding purposes.

INTRODUCTION INTO THE PHILIPPINES.

The custardapple, sugarapple, and soursop were early introduced into the Philippines by the Spaniards. The custardapple was referred to as early as 1609 by Antonio de Morga in a work published in that year, and the soursop and sugarapple are mentioned by Ray in 1704.[1] It is most singular that the best esteemed species of the genus, the cherimoya, a native of many of the Spanish colonies in tropical America and early introduced

[1] Ray J., Historia Plantarum, 1704: Vol. III: Dendrologiæ, p. 77.

into Spain, was not transported to the Philippines by the Spaniards. Not until 1904 was the cherimoya authentically introduced into the Philippines by the then horticulturist of the Bureau of Agriculture, Mr. W. S. Lyon, and while this first introduction was unsuccessful, a second introduction of this species in 1908 by Mr. Lyon was successful. During the past year the writer has obtained seed and budwood of the cherimoya from several correspondents in different parts of the world from which several hundred plants are being propagated, and there is but little doubt that the introduction of this species into the Philippines may now be considered permanent. The mamon has also been introduced during the past year to be used as a stock for the other species and seems to be perfectly at home. The only species of *Rollinia* extant in the Philippines is the biriba which was introduced in May, 1910, from Brazil by Mr. Lyon; budwood of this species was also obtained from Florida in April, 1912, by the writer.

DESCRIPTION.

The cherimoya is a shrubby tree indigenous to Ecuador, Colombia, Central America, and probably Mexico, attaining a height of 4.5 to 6 meters, with long, slender branches and ovate or oblong leaves, obtuse or acute, sparsely hairy above, velvety beneath. The fruit is heart-shaped and varies in size from a large apple in the unimproved forms to 5 kilograms in weight in the cultivated varieties. The whitish pulp in which the seeds are embedded is subacid and of delicious flavor. In Peru and Chile, where the fruit is reported to attain its greatest excellence and is much esteemed, extra large fruits are sold for $2 gold. The cherimoya, by some writers, has been considered to be one of the world's three most delicious fruits.

The sugarapple is a shrub, 3 meters or more tall, and less diffuse in habit than the cherimoya. The fruit is not unlike a short pine cone, usually irregular in outline, 75 to 100 millimeters or more in diameter. The prominent carpels are green, and whitish or yellowish at the base. The white pulp in which the numerous seeds are embedded is sweet and of delicate flavor. The sugarapple is a native of tropical America, but has been distributed throughout the Tropics everywhere and is probably cultivated more generally than any of its congeners.

The soursop is a small tree, 3 or more meters in height with lustrous dark-green leaves. The fruit attains a size of 450 to 2,700 grams, not infrequently exceeding this size; in fact, fruits of twice this weight are reliably reported from Porto Rico; in form they are irregularly oblong or conical, green, and covered

with soft spines. The pulp is white, rather fibrous, juicy and pleasantly subacid in flavor, and contains numerous seeds. The species is indigenous to the West Indies, but is now well disseminated throughout the Tropics.

The custardapple is a tree 4.5 to 7.6 meters high, the leaves being oblong or linear-lanceolate, and smooth. The fruit is heart-shaped in outline, smooth, yellowish or brownish, reticulated, and 75 to 150 millimeters in diameter. The pulp is cream-colored, sweet, rich, and of good flavor. The seeds are numerous and placed closer to the center of the fruit than the seed in any species previously described. The custardapple is indigenous to the American Tropics and well distributed throughout the Tropics in other parts of the world.

The mamon or pondapple (*Anona glabra* L.) is indigenous to the tropical portion of Florida, inhabiting low and marshy lands subjected to overflow, and occurs also in other parts of the American Tropics. The fruit is very much inferior to that of the species already described and seldom eaten, but the plant is more vigorous than any of them, trees sometimes exceeding 7.5 meters in height, having a trunk 50 centimeters in diameter. On account of its vigor it has been thought that the mamon might make a very good stock for the less vigorous cultivated species, and that much land which on account of low elevation is unsuited for the cultivation of other fruits, may, by the use of this species as stock, be devoted to the cultivation of the cherimoya, custardapple, and soursop—provided that the physiological actions of the budded plant are not unfavorably affected by having a top of a species that is adapted to a well-drained situation. On well-drained land the experience in Florida with the mamon as stock for the cherimoya and the custardapple, though limited to a few trees (the oldest budded trees are now over seven years of age), has been very promising. The longevity of the trees can, of course, only be ascertained as time passes. The quality of the fruit does not seem to be unfavorably affected by the stock, which, as is natural, has a slight tendency to outgrow the top.

PROPAGATION.

General remarks.—Experiments in budding the cultivated anonas on the mamon were started by the writer in August, 1904, when a few cherimoya buds were inserted on mamon stock. The work was successful and the following year the custardapple and soursop were also successfully budded on the same stock and various methods of grafting and budding were experimented with extensively.

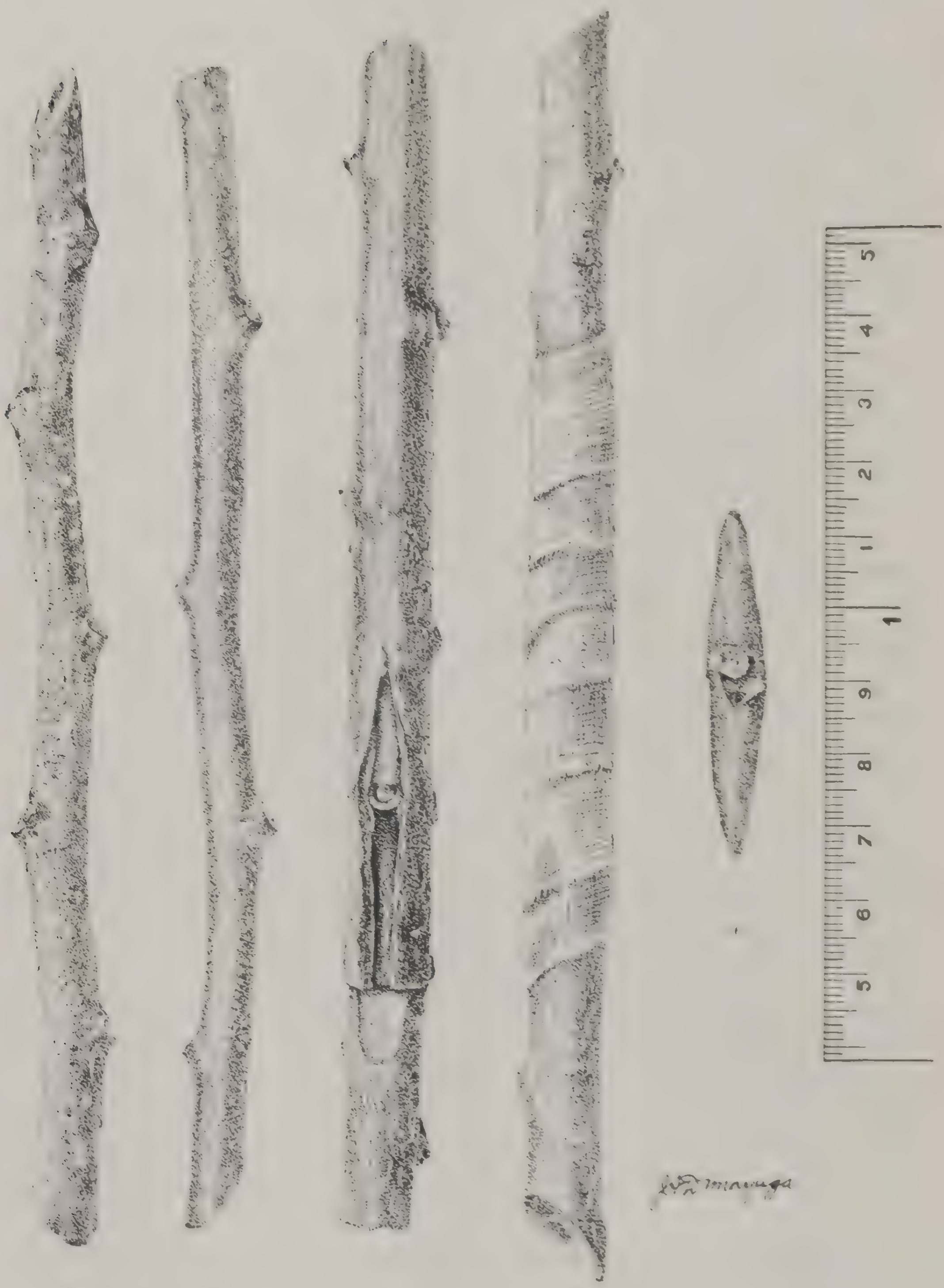
The following species have been successfully budded: On the mamon, the cherimoya, the custardapple, the soursop, and the biriba; on the custardapple, the cherimoya and soursop; and on the sugarapple, the cherimoya. As new species are introduced into cultivation the list of species of *Anona* and *Rollinia* that can be budded reciprocally will no doubt be greatly extended.

Growing the stockplants.—The seed should be washed and all pulp removed, which is most conveniently done in a coarse-meshed sieve that allows the water and pulp to pass through freely. After drying, store the seed in a cool, dry place and plant as soon as convenient.

Sow the seed thinly in a flat or shallow box, well drained by the use of coal ashes, potsherd, or broken rocks, or in a seedbed, and cover them with not more than 12 millimeters of soil. The germinating medium should contain but little, if any, clay, a light soil, rich in humus, being preferable. After germination the plants should be kept rather dry until transplanted. Remove the young plants from the seedbed and set them out in a bed or frame as soon as from two to four true leaves have appeared by using a pointed stick or dibber, setting the plants 13 centimeters apart each way. At the same time cut off the taproot to encourage a better lateral root system. With proper care the young plants make a rapid growth and in a few weeks are ready to be transplanted to the nursery. Perform this work preferably on a cloudy day or late in the afternoon after first having pruned off about two-thirds of the foliage and the tender growth, and after having pruned the taproot to within 12 to 15 centimeters in length. Unless rains render this unnecessary, always water the plants thoroughly before and after transplanting.

Budding.—The results obtained in the experiments conducted by the writer in south Florida indicate that in the nursery the method of shield-budding is preferable to any other method of propagation, the success with which this method was attended in experimental work covering several hundred plants having been all that could be desired.

The plants may be budded any time of the year provided the sap is flowing freely, but under ordinary conditions it is well to perform the budding as early in the spring as possible in order to give the buds the benefit of the entire season's growth. The last year's growth after the leaves have shed is the best budwood material, though older wood may be utilized if scions are scarce. The bark of the anonas is thick and the callousing rapid, and in order to enable the buds to sprout and to prevent them from being smothered by the callus, the buds should, therefore, be cut large



a *b* *c* *d*

FIG. 2.—Shield-budding the *Anonas*. *a*. Budwood of the custardapple; *b*. Cherimoya budwood; *c*. Bud inserted; *d*. Bud tied; *e*. Bud.

with an ample wood-shield. The soft wood of the anonas renders this easy of accomplishment. On account of the thickness of the bark it is well—not to say necessary—to make a sloping cut in the bark below the horizontal cut in order to facilitate the insertion of the bud without injury. While other material such as raffia and cotton twine may be used, waxed tape, covering up the entire wound, is the most preferable for tying. (See Fig. 2.) After ten or twelve days the buds should be examined and if a union has been formed, the buds should be unwrapped to below the leaf bud and the stock lopped. All adventive sprouts should be removed with a sharp knife every ten days to assist in the prompt forcing out of the buds before they are calloused over. If the budded plants are well cared for they will be ready for planting in the orchard eight months after the insertion of the bud.

Comparative value of different species as stocks.—The value of the different species of anonaceous plants as stocks depends largely upon their adaptability to the land and the climatic conditions in which they are grown, and this must be worked out locally. The longevity of the trees of a species should also be considered in the selection of stocks, other qualifications being equal. The vegetative propagation of these plants is so recent that no comparative experiments of the suitability of a certain species as a stock for another have been made.

The most vigorous and as far as known perhaps the most long-lived species of all the anonas is the mamon, and while the natural habitat of this species is low and marshy land, seven years' experience in South Florida seems to indicate that it makes a good stock on well-drained land; it has a well-developed root system, and transplants well.

Perhaps the next species in point of vigor is the custardapple. This species succeeds on well-drained land and seems to be particularly well adapted to land with a scarcity of soil and where the precipitation is not overabundant. It has a strong taproot but is rather deficient in laterals; however, this can be corrected by judicious root pruning. The longevity of the tree makes it a fairly satisfactory stock from this point of view.

The sugarapple grows well on drained land and succeeds on land having scanty soil. It is less long-lived than any of the species under discussion and of less vigorous growth, and would thus appear to be the least desirable stock to use where the other species succeed equally well. Its root system is weaker than any of the other species, and like its congener it transplants without difficulty.

The soursop is of good vigor and rapid growth and has a better developed root system than any of its congeners, and succeeds well on any well drained, moderately rich soil.

Judging from the ease with which three-year-old mamons have been cleft and side-grafted by the writer, this method should prove very successful in the working over of old seedling trees. Where for some reason the grafts fail, the sprouts that issue from the trunk may readily be shield-budded and the plant treated as already described under the paragraph on budding.

In the course of experiments conducted at the Subtropical Laboratory, Miami, Florida, 1909, the writer found that *Asimina triloba* L. readily unites with the mamon and several buds made a healthy growth of 20 to 25 centimeters, dying, however, during the following winter. Whether this was due to uncongeniality between stock and scion, or to climatic conditions, which must have been somewhat trying to the *Asimina triloba* in south Florida, is uncertain. The fact that these two species were sufficiently congenial to grow upon one another may indicate that they are so closely related as to render possible their hybridization. If the *Asimina triloba* can be crossed with the tropical anonaceous fruits, the semi-tropical regions of the world would gain a group of new, distinct, and in all probability, very delicious fruits, in addition to those these regions already possess.

Plate I is a reproduction of a photograph taken in Miami, Florida, by the writer and is published by the courtesy of Mr. David Fairchild, Bureau of Plant Industry, United States Department of Agriculture.

Plate II.—CATANDUANES MARE.

STOCK BREEDING IN THE CATANDUANES ISLANDS.

By E. H. Koert,

In Charge of Live-stock Breeding, Catanduanes.

Stock breeding in the Catanduanes Islands, prior to 1911, did not exist under the general acceptance of the term, the custom being merely to herd a number of animals together and let nature take its course. There were a few rare instances where the owner of a large number of animals would import or, as in the case of horses, buy a sire locally, and turn him loose in the herd, thus making a temporary improvement in the breed.

There are but few people who have more than three or four head of horses and carabaos, the greater number of animals being owned by individuals possessing but one or two head. The best animals of all classes are those held in out-of-the-way places in the mountains; as these are under the supervision of the entire family they receive good care and are generally the best to be found.

HORSES.

Prior to 1912 the Catanduanes pony was almost an unknown quantity; it was known that these ponies existed but Catanduanes was never given credit for their real worth; if in the course of events one of this type reached Manila and made a name for himself either on the track or in the harness, the Province of Albay was given the credit, although the province proper has probably never had a surplus horse to sell in its existence. It is extremely doubtful whether the name Catanduanes has ever appeared on a program of the Manila Jockey Club.

During the past year a change has been brought about by the work done by the Bureau of Agriculture through the stationing of stallions on the Island of Catanduanes. From a total of three head at one station in January, 1911, this number has now increased to eight head, with two stations. The main Island of Catanduanes being naturally divided into a northern and a southern section, half of the horses are stationed in the south at Virac and the other four at Bagamanoc, which will be quite accessible to both Pandan and Viga in the north, once communication is established along the line proposed and inves-

tigated by the Bureau of Public Works. The advisability of this road has been admitted but no data are available as to when the work will be begun; delay in this proposed work will retard the development of Catanduanes very much.

The people of the south have established a small farm for breeding purposes and agricultural experiments in the vicinity of Virac and have shown a very general interest in agricultural improvement. The fact that the horses are at fixed stations gives the men in charge an opportunity to become better acquainted with the people and they are thus enabled to exert a beneficial influence; also knowing just where to find the horses, the people are more apt to present their mares at the proper time.

Prior to 1911, the stock was merely turned out to pasture on the rice fields, which become communal pasture after the harvest, and here each stallion could be found in his own portion of the field with his remuda of from eight to twelve mares.

This would have given fair results were it not for the fact that the better grade of stallions were constantly being taken up for work or sale, leaving the scrubs behind in charge of the field. This condition was somewhat ameliorated by elimination of the weaker mares in their struggle for an existence. Mares have always been the burden bearers in Catanduanes and very few are sold out of the islands, the saleable males being exported when young; thus the mares have been for many years, and are now, much superior to the average mature males remaining in the country.

Extensive inbreeding resulted from the co-herding of the same animals year after year, since a stallion sold or taken away was not replaced by one better or of a different strain, but more likely by one of his own offspring.

In spite of all disadvantages the Catanduanes pony has held his own. The rugged contour of the country, hard use and lack of care and consideration, has made his a case of "the survival of the fittest;" the bones of the weaklings can be seen on the beaches where they have been deposited by the waves after being carried out to the ocean by the mountain torrents of Catanduanes.

In past years, with the beginning of the rice-planting season, the horses were transferred to the communal pasture (up-land); this is still done in the districts of Pandan, Viga, and Baras where large areas of cogon can be found. In the south, at present, the horses do not fare as well, being cared for by the

individual owners in the cheapest way possible, generally by tying them out in a fence corner and often leaving them without a change of site or a drink of water for days at a time. Conditions are improving considerably, however, and where formerly the horse was absolutely at the mercy of the servant, he is now quite often an object of affection to his owner. Improvement in the care of horses has been brought about by the example set in the care of the Bureau horses, by showing the people the general advantages and the resulting increase in efficiency, and largely by the increase in price. Where a year ago the local price was from ₱20 to ₱40 it is now fully double this, with the buyer having to hunt the horse instead of the horse hunting the buyer, as formerly. Only one mare with a mestizo colt has been sold so far; this was a case of the owner selling merely to please a friend outside of the island, the price being ₱125. There are a great many offers of even larger amounts without finding sellers. The Bureau of Agriculture stallion "Duke of Albany" is the favorite and his colts are showing his type very strongly. During the season of 1911, 160 services were rendered by the horses stationed in Virac.

A great factor in the rapid success in improving the stock of the islands will no doubt be the fact that the people are willing to have their inferior native stallions castrated. This work is now being carried on in all but one municipality and will be introduced there very shortly.

The accompanying cut is of a type of horse found extensively in the Islands of Catanduanes.

CARABAOS.

Carabaos have more than held their own in all parts of the Catanduanes Islands and have increased sufficiently to warrant the exportation of a considerable number annually to Luzon. On a recent trip of the steamer *Magallanes* a deckload of thirteen head was noted by the writer. The breeding of the carabao is generally the same as in other parts of the Philippine Islands, except that in the municipality of Bato the conditions appear to be distinctly local. Very little work is found for the carabao in Bato outside of the annual work in the rice fields, as transportation of products is either by boat or man. The Bato River which traverses the island for two-thirds of its length follows a winding course from mountain to mountain, leaving wide stretches of alluvial deposits in the shape of triangular peninsulas. During the rice season on each of these peninsulas herds of carabaos can be seen grazing in charge of a herder; after

the harvest they roam at will. On account of the liberty enjoyed by the animals the best bull is the leader of his individual herd and this has been a factor in making the Bato carabao one of the best to be found in the Philippine Islands. In the one municipality of Bato there are over 1,300 head of carabaos. Of carabaos alone the Islands lose annually a considerable number on account of the difficult trails, many animals becoming exhausted on the steep grades and falling down precipices into the boulder-strewn mountain torrents.

Next to Bato the newly-created municipality of Baras has the largest number of carabaos; however, it is practically impossible to export the animals from here on account of the difficulty in taking them to Virac, the port of call of steamers.

CATTLE.

The Catanduanes Islands have as a nucleus some 600 head of native cattle owned by only a few individuals. Some improvement has been made by the introduction of Chinese bulls. There is also an Australian range bull on the Island of "Panay," off the north coast of the main Island of Catanduanes. Some Spanish fighting bulls introduced have resulted only in producing a small number of vicious offspring, which left in the open pasture seem to have a greater propensity for fighting than for anything else. In the district around Virac several excellent herds are to be found and these have access to a fine Nellore bull supplied by the Bureau of Agriculture. This bull has taken well to local pasture and conditions and the resulting Nellore-native crosses will do much to increase the interest of the people in stock breeding.

GOATS.

Large numbers of goats are to be found in all parts of the islands and constitute the principal meat ration of the people. Some improvement has been made by the introduction of a few choice animals now and then by a particular fancier.

SWINE.

The purely native, local pig is heavily interbred with the wild pig and is a poor specimen of the swine family. In the vicinity of Virac a little improvement has been made by the introduction of Spanish boars by a local firm and, during the past year, through the fact that the Bureau of Agriculture has a fine Berkshire boar located on the "Bicol Farm," the breeding station and farm donated by the people of the southern part of the island.

HIBISCUS CANNABINUS L.

By M. M. SALEEBY, *Fiber Expert.*

INTRODUCTION.

The *Hibiscus cannabinus* is an annual plant widely distributed throughout many of the provinces of British India where it has its original home. Considerable interest in its cultivation for the fiber has lately been taken up in India, Indo-China, and Java, and the superior quality of its fiber and the simplicity of its cultivation promise a much wider and a more general interest in its cultivation throughout a large area of the eastern tropical and semi-tropical countries. Notwithstanding the present general cultivation of this plant in India, its fiber has hardly yet been produced as a distinct article of commerce. As far back as 1855 samples of the fiber were introduced into the English and other European markets but it was not until a comparatively recent time that there has been an attempt to give a distinct name to the fiber. This explains why no sufficient interest has heretofore been accorded to it.

Climatic and soil conditions in the Philippines are apparently highly suitable for the cultivation of this plant, and the object of this paper is to awaken the interest of the Philippine planter in this new product and give him preliminary information regarding the methods of cultivating the plant and extracting its fiber. Inasmuch as this plant has not yet been introduced here, the following information may be accepted as only tentative.

NOMENCLATURE.

The different countries which grow the *Hibiscus cannabinus* have their own local names both for the plant, and also for the fiber which is produced from it. In India where, as I have mentioned before, this plant is more widely grown than anywhere else and where it is indigenous, we hear of the *ambari, deccan, gambo* and several other less known vernacular names; in Java, where its cultivation has only recently been given any widespread interest, it is known as *Java jute.* As the splendid

qualities of this fiber become more generally known to the fiber markets of the world and its cultivation becomes more extensively and more systematically carried on, it is hoped that an effort will be made to give to the fiber only one commercial name by which it shall be universally known.

DESCRIPTION OF THE PLANT.

Annual, *leaves* midnerve glandular beneath, petiole prickly, long; *stipules* linear, pointed; *flowers* axillary, open for a few hours only; *peduncles* axillary, very short; *epicalyx* shorter than the calyx, stiff, consisting of 7–10 bracteoles connate below, free above; *calyx* connate below, free above; *sepals* bristly, lanceolate, with a gland at the back of each; *corolla* large, spreading, thickened below, very thin above; *capsule* globose, pointed, bristly, *seeds* nearly glabrous.[1]

There are five varieties of this species which differ from each other in the color, shape, and extent of growth of the stem; in the shape of the leaves and the color of the petioles; in the vigor and duration of the growth of the plants; and in their suitability for fiber purposes.[2]

The above description of the plant is probably the only one so far published that applies to the different varieties. Other descriptions, which were evidently given before any comprehensive study of the varieties was made, differ especially in those characteristics in which the different varieties do not agree.

SOIL AND CLIMATE.

Average conditions of climate, such as exist in the greater part of the eastern tropics, are well suited for the successful cultivation of *Hibiscus cannabinus.* Ordinary rainfall is required, and the slight variation of temperature does not seriously affect its growth.

The soil must not be very poor, nor is it necessary that it should be particularly rich. It must, however, be very well drained and well aerated. In all waterlogged soils the development of the roots is usually very poor, the leaves are small and unhealthy, and the whole plant is stunted and usually dies before it has reached its fullest extent of growth and development. Similar effects also take place when the soil is not sufficiently aerated. To remedy the latter defect, the soil must be kept

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[1] Memoirs of the Department of Agriculture in India, Botanical series, Vol. IV, No. 2, p. 21, by Albert & Gabriel Howard.

[2] For a more detailed description of above varieties see publication referred to above, p. 16.

regularly stirred as soon as the plants stop growing and begin to look sickly. Such a treatment, applied in time, will revive the plant and keep its growth unhindered. In soils that are well drained and well aerated the cultivation is simple and the best results assured. It is probably for this reason that the plant is found cultivated by the natives of India and Egypt on elevated borders of fields of cotton, rice, or some other crop, for protection from cold or wind.

PLANTING AND CULTIVATION.

The plants are grown from seed which must be sown rather thick. The object of thick planting is threefold: First, it will help to kill all the undesirable undergrowth and keep the soil clean; second, it will protect the soil from the excessive heat and will keep it soft and moist during the dry spells; and third, it will tend to produce small, but long, stems having a long and fine fiber.

Before planting commences provision must be made to facilitate drainage when necessary. After planting the soil must be regularly cleaned from all kinds of undergrowth until the plants are high enough to shade the soil, when nothing more will be required in the way of cultivation until the plants are ready for the harvest. This plant is of a very rapid growth and usually in about one hundred days from planting it can be harvested.

So far the plant has no serious enemies nor diseases, and the crop is assured.

EXTRACTION OF FIBER.

The stems are usually sufficiently matured for cutting and retting in about three months from the time of planting the seed. There seems to be a difference of opinion as to the most desirable stage at which the stems should be cut. Some authors claim that the stems, cut after the fruit has been fully developed, will produce a stronger fiber than when cut before; others hold a view directly contrary to the above and claim that the stems, while in flower, produce a stronger fiber; still others claim that the crop should be harvested when the first formed seeds are just ripe and while the upper portion of the plant is still in flower. Until tests bearing on this point in dispute have been made by the fiber office of this Bureau, the writer is inclined to recommend the last practice.

For lack of suitable machinery the fiber can be cleaned only by retting the stems in water in a manner similar to that used with jute. The bundles should be put in the water in a vertical

position with the thicker, or root, ends under the water. These bundles should be kept in this position for a day or two until the lower bark is fairly well soaked, after which they can be laid horizontally. The bundles must be completely immersed in water for a period of eight to ten, or more, days, when they can be taken out and the fiber separated from the decomposed bark by the ordinary process of beating and brushing. It is necessary, however, that the water used for retting the stems be free from impurities, and it must, therefore, either be running water, or provision must be made to have it changed every day.

At the Fiber Congress held in Surabaya, Java, during July of last year, the writer saw samples of this fiber cleaned by the Faure machine. On comparing them with other samples prepared by retting, the former proved to be inferior in many respects to the latter.

YIELD AND COST OF PRODUCTION.

The estimates of the yield of fiber per hectare as given by several planters at the Surabaya Fiber Congress were very conflicting. Some planters put the average yield at 500 kilos ($7\frac{1}{2}$ piculs), while others put it as high as 1,700 to 1,900 kilos (28 to 30 piculs). This variation is probably due to the fact that the cultivation of this plant in Java is comparatively recent, and the tests are not sufficient to warrant giving more definite results. According to Dodge, in his work entitled "Fiber Plants of the World," *Hibiscus cannabinus* gives an average yield of clean fiber of $2\frac{6}{7}$ tons per acre, or approximately 6 tons per hectare. These figures, however, are of no value to the farmer, as they are computed on laboratory tests based upon the amount of fiber produced by one stem. He assumes that an acre will produce 640,000 stems at 7.62 centimeters apart and averaging 0.46 kilogram of clean fiber per hundred stems. It is, however, almost universally agreed upon that the weight of dry fiber can be safely estimated at $1\frac{1}{2}$ to 2 per cent of the total weight of the stem.

The cost of production is another point that has not yet been definitely ascertained; besides, the results arrived at in this connection are bound to vary in different countries where the quality, supply, and wages of labor differ. The cost of production in the Philippines will probably be somewhat higher than in India and Java. This fact, however, will not prevent this Bureau from conducting the projected series of experiments in the cultivation and preparation of this fiber.

VALUE.

Though this plant has been for some time cultivated in India and other countries, its fiber has not yet been established as a distinct article of commerce. Small quantities of this fiber occasionally find their way to some of the fiber markets of the world, but in no case has it been exported in large enough quantities to give it any considerable attention by the manufacturers; besides, it has been exported from different countries—and sometimes even from the same country—under different names, to which fact is due the ignorance of the fiber manufacturers as to its real merits and as to the different uses for which it is highly suitable.

The fiber sent in small quantities from Java to several of the European markets was quoted at a price equivalent to 17½ centavos per kilo. The highest price was quoted on the London Market at 22½ centavos per kilo, and it was also reported, though it could not be verified, that there was one firm in Surabaya that offered 38 centavos for every kilo of the fiber.

THE FIBER AND ITS USES.

The fiber is a bast and is described by some writers as being soft, white, and silky. Other writers describe it as being more durable than jute and more suitable for coarse textiles. Perhaps the most comprehensive description of the fiber is the following, taken from Hanausek's Microscopy of Technical Products:

DESCRIPTION OF THE FIBER.

The fibres are yellow-white to grey-yellow, slightly lustrous, somewhat lignified. On treatment of a cross-section with iodine and sulphuric acid, it is evident that the lignification is not uniform throughout. In many fibres the walls are yellow, with a rather brown outer lamella; in others the inner layers of the walls are deep blue, only the outer lamella being yellow. Whole fibres treated in the same manner also show irregularities in colour. These differences may explain some of the contradictory statements of different authors . . . .

Microscopic structure.—The technical fibres consist only of bast fibres. These are up to 6 millimeters long, 14–16 μ broad, and are either blunt, sometimes with a very short lobe near the end, or else pointed, the wall at the ends being in both cases very strongly thickened. The lumen in one and the same fibre shows very great variation in diameter, in some parts it is broad, in other parts narrow, and in still other parts disappears entirely. Frequently it is alternately broad and narrow. In cross-section the fibres are seen to be closely united, and are either polygonal with sharp angles and straight sides or rounded polygonal with sharp angles and oval, the lumen in the first case being usually small, often a mere

point, in the latter case large and oval. Cross-sections examined in water show a broad, distinct outer lamella, but concentric rings are evident only in some of the angular forms and in those but indistinctly.[1]

At the Surabaya Fiber Congress, Prof. Van Iterson of Delft, Holland, stated that the microscopic examination of the Java jute demonstrated that its cells are much longer than those of the Indian jute, *Corchorus* spp. The former was also stated to be one and one-half to two times as strong as the latter. Chemically examined, however, both fibers reveal the same characteristics.

Most of the fiber produced in India is used locally in making strings, coats, coarse sack cloth, canvas, and fishing nets. In Egypt, where the plants are set out on the borders of cotton fields to protect them from cold and sand-storms, the natives use the fiber for making ropes for their ordinary daily use.

In Java the fiber is used for making ropes, sacks, packing cloth for machinery, and other similar articles. The fiber, as well as the waste, is also believed to be suitable for paper manufacture; but, so far, no tests have been made to ascertain the fact. It was also suggested that the seeds contain a fair amount of oil and therefore may possess some value, but this suggestion also could not be backed by definite proofs. The plant, however, bears seeds profusely, which are covered with numerous stinging bristles, making it necessary for the men to put on gloves while they are picking them.

CONCLUSION.

The results of the most recent tests made with the fiber of *Hibiscus cannabinus*, in comparison with jute and other allied fibers, have in most cases shown that the former is in many respects equal, if not superior, to the latter, and can be used for the same purposes. The current opinion in Java is that the fiber of *Hibiscus cannabinus* has a wider range of uses than jute, to which it is decidedly superior in strength and fineness. This belief was not based merely on the laboratory tests made with the two fibers, but also on the quotations that were received on samples of the former fiber forwarded to the English and Dutch markets, and which proved, in most instances, higher than those listed on the latter. The first incentive for growing *Hibiscus cannabinus* in Java was to produce a substitute for jute in the manufacture of burlap for making sugar-bags and other similar articles, which they were, and are still, importing in

[1] Reproduced from the Memoirs of Department of Agriculture in India, Botanical Series, Vol. IV, No. 2. Studies in Indian Fiber Plants, No. 2, page 11.

large quantities from British India. The results of several recent trials have proven that there can be no question as to the suitability of the former for making sugar-bags, but it has been found that it is too fine and too good to be used for this purpose. By exporting it to Europe they found that it was worth more to them than if it had been locally manufactured into bags.

Here in the Philippines the sugar industry is growing at such a rapid rate that it is a question of very few years when we shall find ourselves importing bags and burlap on a much higher scale than we are doing at present. The introduction of modern sugar mills and refineries, which has lately begun, is bound to continue. This will naturally create a strong demand for any fiber that can be used as a substitute for jute in the manufacture of bags and burlap.

In this connection the following statistics from the report of the Insular Collector of Customs for 1910, showing the quantity and value of the importations of bags and burlap during the last three years, will be of interest:

	1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Kilos.		*Kilos.*		*Kilos.*	
Bags	1,207,506	$77,261	1,281,763	$79,921	495,017	$30,662
Burlap [a]					1,770,879	59,172
Total		77,261		79,921		89,834

[a] The importation of burlap did not commence until recently when bag factories were established in Manila.

With the above facts and prospects in view, the fiber office of this Bureau has decided to conduct several experiments with the growing of *Hibiscus cannabinus*. It must be understood, however, that the cultivation of the above plant, owing to the comparatively low price of its fiber, can be most advantageously carried on by natives as an alternate crop with rice, corn, or some other crop. For this purpose this plant is admirably suited, because of the short duration of its growth, only one hundred days being necessary to bring it to the cutting stage. The wide range of soil and climatic conditions under which it can be satisfactorily grown, the simplicity of its cultivation, and the superior quality of its fiber and its varied uses all point to the advisability and wisdom of conducting extensive experiments with it here in the Philippines. The results of these experiments will, of course, determine what further course in this connection will be taken by this Bureau.

AGRICULTURAL CONDITIONS IN THE PROVINCE OF CEBU—APRIL 15, 1912.

By GEO. G. WEATHERSBEE, *Agricultural Inspector.*

A protracted drought has caused considerable damage to crops in all sections of the Province of Cebu. Continuous hot weather with practically no rain for about four months has caused the ever recurring question of a sufficient food supply to assume serious proportions. Without rain the farmers can not plant, and early relief from the next harvest can not be hoped for. Corn from the last harvest is practically exhausted in many sections. Some corn is being harvested at the present time, but the crop is so poor that it will serve only as a temporary relief. In the northern part of the province, where the December and January corn crop was very poor, many people are feeling the effects of a shortage of food. Reports have recently come in to the effect that even in some of the more prosperous towns along the east coast the people are using flour made from the heart of the buri trunk, because of the scarcity of corn and rice. As a rule, buri flour is eaten only when other food is not obtainable.

Contrary to usual conditions, considerable areas of land generally planted to corn and sugar cane are vacant because of the drought. On the exposed mountain slopes, where the soil dries out most rapidly, practically no plantings have been made since the December harvest.

The soils in Cebu vary greatly in different parts of the province. The general type of soil on the coastal plain in the towns along the railroad from Cebu to Argao is a black vegetable loam, containing a large percentage of clay, well suited to the production of corn and sugar cane. The mountain soil in these towns is shallow and very rocky, though in the mountain valleys there are some very fertile alluvial soils. In the town of Carmen, there are large areas of heavy soil, known as "gumbo," excellent for the production of sugar cane. Northward from

FIG. 3.—Map of Cebu Province.

Carmen to Bogo, the lands are rolling and covered with coral rock. The only really good agricultural lands in this section are in small patches in the mountain valleys. In the mountains near Bogo there are extensive areas of heavy black "gumbo" and lighter vegetable loams, rendering this town one of the richest agricultural sections in the province. In the northern towns of Medellin and Daan-Bantayan, there are extensive areas of heavy black soils near the coast, varied with rocky and clayey soils in the mountains. On the west coast from Toledo northward, the soil on the coastal plain is a black vegetable loam, though where the hills come down to the coast the land is very shallow and rocky. In Barili and Dumanjug, there are level and rolling areas of fertile, black soils. Southward from Dumanjug, and around the south coast to Dalaguete, the mountains are close to the coast, and the soil is shallow and rocky, though there are some very fertile spots in the mountain valleys of these towns.

In the Province of Cebu as a whole, agricultural methods are very primitive. There is very little modern agricultural machinery in use, most of the soil preparation and cultivation being done with old-fashioned native carabao plows and with bolos. Shortage of carabaos and other work animals is a serious drawback to agricultural progress, as, at a conservative estimate, there are not more than one-third enough carabaos in the province to properly perform the necessary farm labor. In the more prosperous towns along the railroad, the farmers have a considerable number of work animals, but in very few instances have individuals sufficient animals to supply the needs of their farms. There are many cases, especially in the mountains, where all work of preparation and cultivation is done with bolos. Cultivation of growing crops is a system that is practiced to a very limited extent. Many farmers never cultivate their crops, and few give more than one cultivation during the growing season. The native plow in common use is a very crude affair that breaks the soil at the same depth year after year, and tends to form a "hard pan" (hard layer in the soil), through which it is very difficult for the roots of plants to penetrate. Use of available fertilizing materials, such as animal manures, vegetable matter, leguminous crops, etc., is very little understood by the farmers and vast quantities of valuable fertilizers are thrown away each year through ignorance. In many parts of the province, soils are becoming infertile because of continuous cropping of the same kind of plant year after year.

Except in the cases of a few of the more progressive farmers, the value of a proper rotation of crops is unknown, corn, sugar cane, tobacco, or other products, having been grown continuously on the same land without interchange for many years. Large areas of unproductive lands could be made fertile by installation of drainage systems in the vicinity of Toledo and other sections, and many farmers understand this need, but are afraid that the increase in productivity would not be sufficient to warrant the expense incident to putting in proper systems of drainage. Owing to fairly regular rainfall, irrigation systems are not of great necessity in the Province of Cebu. Rice culture in some of the towns along the railroad and in some sections of the west coast, however, could be made of greater importance by more extensive irrigation.

The majority of the agricultural lands in Cebu are under cultivation, especially in the thickly populated towns along the east coast, and in many cases the farms extend to the tops of the mountains. Every available foot of land is planted to corn or tobacco in the mountain section between Carcar and Barili, though much of it is so steep that it is impossible to use plows, necessitating hand labor. Between Toledo and Tuburan, and in the northern towns of Medellin and Daan-Bantayan, there are extensive tracts of level lands that have not been cultivated for a number of years. This waste of good farming land is attributed to shortage of carabaos. There are level sections where cogon and other grasses are so rank that the farmers consider the caiñgin system of cropping in the mountains preferable to the tremendous labor of clearing the level lands with bolos.

According to the opinions of some of the prominent farmers of Cebu, the most serious drawback to agricultural development is the lack of valid land titles. Less than 5 per cent of the total land owners in the Province of Cebu have titles to their properties. This means that very few farmers can borrow money from the Agricultural Bank or from other sources, and many farmers who lost the majority of their animals in the rinderpest epidemic are unable to replace these animals because of lack of funds. In the municipality of Liloan, the farmers have expressed a desire to purchase steam plows to do the plowing for the whole community, but they are held back at present through shortage of capital. The farmers of Bogo and Daan-Bantayan, who wish to have their lands surveyed, have organized for the purpose of requesting surveyors to make all surveys

in the towns at one visit in order to decrease as much as possible the cost to the individual land owners. Some farmers are trying to make arrangements by which land surveys can be made more cheaply and farmers given extension of time for payment.

Corn is the most important crop in the Province of Cebu as a whole; it is the principal food of the people and is grown to a greater or less extent in all sections. Barili is the most important corn-growing town, and is the only place from which large quantities are exported. Outside of Barili, corn is grown mainly for local consumption only, three crops per year being harvested in most parts of the province. It is grown extensively both in the mountains and on the level lands near the coast. The average production is about 20 cavans[1] per hectare, and the best quality comes from Barili, Toledo, Bogo, and the towns along the railroad south of Cebu.

The corn crop this season is practically a failure. With little rain for about four months, corn has suffered heavily in all sections of the province. In the province as a whole, the corn crop in December and January was poor; and with corn almost a failure this season, hard times are inevitable. In the mountainous valleys in the center of the island where there has been a little rain throughout the season, the corn crop is fair; but along the coast, many fields that were planted in January failed absolutely to produce anything. A small amount of corn planted in rice paddies will produce fairly well. In all sections, however, the yield of corn is much below normal. Corn is selling at the present time at ₱5.25 per cavan in the Cebu market.

Corn is usually planted at a distance of a little less than 1 meter between the hills, and from five to six grains are planted in each hill. This close planting tends to greatly detract from the quantity and quality harvested. The ears are as a rule small and poorly filled out, though on some individual farms in Toledo, Barili, Bogo, and Carcar, some very fine corn is produced. In the towns where there is a large percentage of level lands, the soil is usually plowed before planting; but on the mountain farms, no preparation of the soil, aside from cutting the weeds and grass, is made. Holes are dug in the ground with bolos, five or six grains are dropped in, and the holes are covered by raking soil over them with the feet. No cultivation is given the growing plants. On the plain farms, there is never more than one cultivation and in many cases none whatever. Very few farmers select their seed corn, the seed for planting the next

[1] One cavan equals 75 liters.

crop being taken indiscriminately from a pile of corn without regard to size or the quality of the ears. Some farmers do select the better grades for planting but this is far from being the rule.

Corn is eaten largely in lieu of rice in this province. It is prepared for food in several different ways, being boiled or roasted green, but it is most commonly eaten as a kind of hominy known as "arroz." This is prepared by grinding the grains between two cylindrical stones which separate the hard part of the grain from the starchy part; the hard portion is boiled and eaten as "arroz," and the soft, starchy portion is fed to horses, pigs and chickens.

Tobacco is the most important commercial product of the province. It is grown to a certain extent in every municipality, though the most important tobacco-producing towns are Tabogon, Carcar, Sibonga, and Argao, on the east, and Tuburan, Asturias, Balamban, Toledo, Barili, and Moalboal on the west coast. A considerable amount of good grade is also produced in the town of Bogo. It is usually very strong and of poor quality, owing to crude methods of planting, cultivation, and curing. The seed beds are sown from September to the first of January.

Very few farmers understand the advantage of planting only the heavy seed, selected from the best plants. Systematic topping and suckering the plants is not generally practiced.

Tobacco is grown both on the coastal plains and in the mountains, though the majority of plantations are in the latter. The best grades are produced in the mountains some distance from the coast, most of the general crop being suitable only for filler. The Compañía General de Tabacos de Filipinas buys most of the tobacco grown and ferment it in their warehouses situated in the principal tobacco centers.

In common with all other crops, tobacco was greatly damaged by the drought. Owing to the fact that the harvest is not yet complete, no accurate figures of the loss are obtainable, but the consensus of opinion is to the effect that the drought will cause a loss of not less than 25 per cent. Tobacco worms have injured tobacco to a considerable extent in all sections. Scarcity and poor quality of seeds were factors that did much to reduce the yield in all sections of the province.

Coconuts are grown in all parts of the province, though most extensively in the towns of Oslob, Boljo-on, and Dalaguete on the south coast. In the towns of Toledo, Balamban, San Remi-

gio, Tuburan, Talisay and Cebu, this industry is of considerable importance, the principal products being copra and tuba. Oslob is the only town in the province where coconut oil is manufactured extensively for export.

All copra produced in the province is sun dried. The ripe nuts are cut in half and placed in the sunshine, where the heat of the sun's rays soon causes the meat to detach itself from the shell. The meat of the nut is then broken into small pieces and placed in the sun to dry until it becomes of a uniform gray color. It is then ready for shipment to the copra buyers. In the manufacture of coconut oil, the meat of the ripe nuts is first grated to a fine pulp, which is mixed with water, and the whole then boiled in a shallow iron pan. As the liquid boils, the oil rises to the surface and is skimmed off. This process continues until all the oil is extracted from the pulp.

The best coconut trees are grown in the sandy lands near the coast, with very few groves in the mountains. The seedlings are planted in shallow holes, of a depth about two-thirds the length of the nut, after which they are usually given no attention. The trees are planted very close together, the average for the province being not more than 4 meters each way, with the result that in many sections it is impossible for the trees to develop to normal size. In some places on the west coast the farmers set their trees from 7 to 8 meters apart in order to utilize the space between the trees for planting corn and tobacco.

Coconuts have suffered some damage from the drought, though the injury is not so apparent as in the case of other crops. The principal loss has been due to the falling off of the flowers before the fruit is formed. The present price of copra in the Cebu market is ₱11 per picul.

There are very few coconut pests in the province. The coconut beetle is found in all sections, but not in sufficient quantities to do serious damage; in a few sections, where rats are troublesome, the people nail strips of tin around the trunks of the trees in order to prevent the rodents from climbing up to the nuts.

Sugar cane is grown extensively in the towns on the east coast from Carmen southward to Sibonga, and in the towns of Bogo, Medellin, and Daan-Bantayan in the north. The production of sugar was an important industry in Toledo and Tuburan prior to 1898, but during the revolution most of the mills were destroyed, and the planting of sugar cane is now neglected. Sugar cane is grown in all other towns to a small extent for local use or export.

As a rule the cane fields are planted very thickly and are

poorly cultivated. The first and only cultivation is given the plants when they are about 6 decimeters high. In many sections the fields grow for several years without renewal. Both the small red variety of cane and the larger white varieties are grown, the former being more common.

The sugar loss due to the drought is variously estimated in the different parts of the province at from 25 to 40 per cent. The harvest, with the exception of a few isolated fields, was completed about the middle of March. The ratoon crop is being severely damaged by the drought. Farmers were forced to make new plantings during very dry weather in order to utilize available seed and many of these plantings have failed and all have been severely checked in their growth because of insufficient moisture. A considerable amount of sugar is being held at the present time because of the low prices. The price of the average grade of sugar in the Cebu market at the present time is ₱7.40 per picul (63.25 kilos).

The old wooden two-cylinder sugar mill, operated by one carabao, is still used extensively in cane-growing sections of Cebu, though it is being rapidly replaced by the more modern three-cylinder steel mill, operated by two carabaos. The farmers are beginning to realize that the steel mills, which will express from 70 to 80 per cent of the juice of the cane, are much more economical than the wooden mills that express only 40 per cent of the juice. In the town of Talisay fifteen three-cylinder mills were recently ordered from a firm in Cebu. Two of the more progressive farmers in Bogo are thinking of purchasing two steam sugar mills this year. There are five steam sugar mills in the province which are no longer in use. Mr. Filemón Mercado, a prominent farmer of Carcar, recently purchased a steel sugar mill and gasoline engine.

The juice of the cane is evaporated in open iron pans built into clay furnaces, the sugar produced being of a deep chocolate color, and of low grade. By several evaporations, a fair grade of light-brown sugar is produced for local use.

The sugar industry is greatly restricted in Cebu by scarcity of work animals. Large areas of fertile sugar land in Toledo, Asturias, Balamban, Medellin, and Daan-Bantayan are uncultivated because of shortage of carabaos and of the necessary capital for development. Antiquated mills and careless methods of cooking are factors that minimize the sugar output of the province.

The principal abacá-producing sections of the province are the towns of Moalboal, Alegria, Malabuyoc, Badian, and Gina-

tilan on the west, and Argao, Sibonga, Carmen, and Catmon on the east coast. It is grown to a less extent throughout the whole remaining mountain section.

Most of the abacá plantations in Cebu are very old, plants having grown continuously from the same roots for many years without renewal. Usually several different varieties are found on the same plantation, no attempt being made to select the best. Little or no cultivation is given the plants.

The stripping is done by hand with knives, and the fiber is placed in the sun to dry. No machines are used in the province. The average fiber is of fair grade, though only a small amount of the best "Leyte" hemp is produced. The current price of abacá for this season's harvest of first-grade hemp is ₱18 per picul (63.25 kilos).

Maguey is generally grown throughout the province, the most extensive plantations being in the towns along the railroad from Danao to Argao, and in the northern municipalities of Daan-Bantayan, Medellin, and Bogo. Largely because of the difficulty of cleaning maguey, many farmers have lost interest in the product, and some large fields have been left to grow up in weeds, or have been cleared and planted to other crops.

Maguey produces well in almost any type of soil. In some towns it is grown on bare rocky hillsides, and in others, on fertile, level lands. The plants are large and healthy everywhere. They are usually set from 9.14 to 12.19 decimeters apart, resulting in an almost impenetrable mass of leaves when they reach maturity. Practically no cultivation is given.

White plant lice, which suck the juices from the leaves, have injured maguey considerably in nearly all localities.

The fiber of maguey is extracted by "retting," or tying the leaves in bundles and placing them in the salt water of nipa marshes for several days. When the leaves reach the consistency of soft pulpy masses, they are removed from the water and the pulp is beaten away from the fiber. The cleaned fiber is then hung in the sun to dry. There are no stripping machines used in the province at the present time. The average price of maguey fiber throughout the province is ₱8 per picul (63.25 kilos).

Palay is a crop of very little commercial importance in Cebu. It is grown in small patches in almost every town, though in no section is there enough produced to supply the local demand, most of the rice being imported. Palay is grown most extensively in the towns of Minglanilla, Talisay, Cebu, Liloan, Carmen,

Mandaue, Argao, and Carcar on the east, and in Barili, Asturias, and Balamban on the west coast.

Rice is grown in Cebu altogether in the low lands. The seed is first sown in seed beds in the corners of the paddies, and when the seedlings are 12.7 or 15.24 centimeters in height they are transplanted to the fields by hand. Some sections are irrigated by conveying the water in ditches from streams, but in many cases the necessary water for irrigation is derived from rainfall. Palay is planted from April to August, the planting time varying in different sections.

The palay crop this season was fair, though shortage of water caused damage in many sections. Palay suffered some injury from stalk borers and smuts.

Cotton is a product of considerable importance in the town of Oslob. There are looms in nearly every house, and enough cotton cloth is woven to supply the inhabitants with clothing. The fiber, which has a rather short staple, is of fair quality. The plants grow in practically a wild state, with little cultivation or attention.

Kapok or tree cotton is grown rather extensively in the towns along the railroad for use in the manufacture of mattresses and pillows for sale in the Cebu market. The trees are usually grown around the edges of fields. Coffee and cacao are grown in small quantities for local use in the mountain sections of practically all towns. In the towns of Badian and Alegria, coffee was at one time an important product, but most of the trees have been killed by a fungus disease.

Many farmers in the province are interested in rubber culture, though very few plantings have yet been made. One farmer in Tuburan has a grove of fifty two-year-old Ceará rubber trees, grown from Mindanao seed, all of which are in excellent condition.

Bananas, mangos, papayas, pineapples, camotes, camoteng cahoy, dawa, ube, gabi, mungos, and various vegetables are grown in all towns for local consumption. Fruits and vegetables are grown most extensively in Cebu, Talisay, and Mandaue, to supply the Cebu market. The finest mangos in the province are grown in the town of Cebu. Papayas from Hawaiian seed produce well in all sections.

Stock raising is an industry of minor importance in this province. Horses are found in small numbers in all parts, though only in Cebu and a few near-by towns are they raised extensively

for sale. Cattle, hogs, goats, sheep and chickens are raised in all sections for local use, though more particularly in Cebu for the local market. There are no farms devoted exclusively to stock raising. With the exception of cattle, some of which are Indian and Chinese strains, all stock is of the common native breeds. Practically no attention is given to systematic breeding of superior animals.

In the public schools of the province, strenuous efforts are being made to make gardening an important branch of school work. Mr. J. C. Muerman, division superintendent of schools for the Province of Cebu, has been working to that end for several years, and in all parts of the province gardens were in evidence during the past school year. The teachers have expressed an intention of conducting their gardening along the most progressive lines, and to make the gardens, as far as possible, models for the farmers of the community.

In the Province of Cebu as a whole, transportation facilities are very good. On the east coast, the Philippine Railway extends from Danao in the north to Argao in the south, a distance of 95 kilometers. The provincial roads of Cebu are among the best in the Islands. There is a first-class macadam road from Carmen on the north central part of the east coast to Dumanjug on the west coast, a distance of 115 kilometers. An excellent road crosses the island from Talisay on the east to Toledo on the west coast. A good second-class road connects Carcar on the east with Oslob on the south coast. On the east coast, from Carmen northward to the northern end of the island, there is nothing more than a rough trail. With the exception of short stretches of good road from Toledo to Balamban and from Barili to Moalboal, the roads on the west coast are very poor. Plans have been made to extend the roads of the province as soon as possible. In many sections the farmers could greatly improve their transportation facilities by opening up roads from their farms to the railroad or to the provincial roads.

CURRENT NOTES[1]—JUNE.

KNOTTED ABACA.

By "knotted" abacá is meant the tying together of several fibers of the finest grades of abacá and reeling them in the form of a hank. Generally the few sheaths surrounding the core of the abacá stalk are selected for preparing the grade of the fiber necessary for this purpose.

It is only recently that the preparation of knotted abacá for export has been started. Owing to the length and rare strength of the abacá fiber, this industry promises to develop rapidly, unhindered by any competition from other fibers. The exports of knotted abacá for the fiscal year 1910 were about 120,000 kilos, valued at approximately ₱300,000. The above figures do not include the finest grades of abacá that were shipped to Japan and other countries where they were knotted and reëxported to Europe. It is believed that the exports during the fiscal year 1911 will greatly exceed the above figures.

It is the aim of this paper to encourage the preparation of knotted abacá as a household industry. This fiber can be produced for export purposes only in those localities where the production of cordage grades of abacá has proved a failure. In all localities where, for some reason or other, abacá fails to attain the satisfactory extent of growth which is necessary to make its production for cordage purposes profitable, the preparation of knotted abacá as a household industry can be resorted to as the only hope of getting any returns.

In the preparation of this fiber the man cuts down the stalks and carefully strips them by the ordinary method. The fiber is then turned over to the women and children who dry and carefully separate the individual fibers, tying them together at their extremities. When a specially high grade of knotted abacá is required, the fibers undergo several processes of washing and beating in mortars, similar to the methods used in preparing the fiber for weaving the "pinocpoc" cloth.

[1] Original notes prepared by various members of the Bureau of Agriculture.

The prices paid in the Manila market for knotted abacá during the year 1911 ranged from ₱1.80 to ₱3.50 per kilo. The present price (March 1, 1912) is ₱2.50 per kilo. The price of the finest grades of loose, or unknotted abacá, however, ranges between 40 and 55 centavos per kilo; some of the extra fine grades, such as those that often come from Cavite and Panay, sell for a still higher price. No definite estimate can at present be given relative to the cost of tying the individual fibers. This is done by women and children who do not work steadily, but rather during their spare time or when they feel like it. The process of tying the individual fibers is tedious and can only be done in the manner referred to above.

The finest grades of abacá are also exported from the Islands in a loose condition. Most of this fiber now goes to Japan where it is knotted in a manner similar to the custom here and then reëxported to Europe.

Knotted abacá, as such, is prepared for use in the manufacture of various grades of cloth, hat braids, and hats. At present it is being exported to Switzerland, Italy, France, and Germany. It has recently been reported that the Japanese have begun to make use of the knotted fiber for the same purposes as in Europe, and the European firms anticipate a keen competition from them.

Experiments are now being made here in Manila to weave certain kinds of coarse and strong cloth to be used on the seats of trains and for other similar purposes. If this cloth proves to be strong and durable enough, we may expect this phase of the industry to develop rapidly. It is rather early, however, to predict the extent to which this new industry can be developed; nevertheless, judging from the increasing uses to which it is being put, it is safe to say that it is destined to rank among the leading household industries of these Islands. (*M. M. Saleeby.*)

BONUS FOR IMPROVED FIBER MACHINERY.

It is with a great deal of interest that we note the efforts put forth by the New Zealand Government to revive the languishing industry of raising and preparing for the market of the New Zealand hemp or flax (*Phormium tenax*). The above industry has suffered considerably from the recent general decline in the price of fibers, and up to the present time it is in a much less encouraging condition than either our abacá industry or the sisal industry of Mexico. The New Zealand Government, after careful investigation of the local conditions and after acquainting itself with the general conditions of the fiber markets of the

world and their requirements, has come to the conclusion that there can be only one method of restoring their hemp industry to its former condition of prosperity, or, at least, of improving it to the extent of increasing the interest of the producers in it, and that is the production of the high grades of the fiber. By suitable legislation it has succeeded, so far, in preventing the local producers from putting on the market fiber below a certain grade. The grades prohibited are those that result from mere carelessness in extracting and handling the fiber. This attempt has proved a success and the Government has recently taken another step in this direction and has offered a bonus of ₱116,800 for any improved method for extracting and preparing the fiber, or for the utilization of all, or any, of its by-products. Any machines or new processes must be submitted to the New Zealand Flax Millers' Association and to the Government, for inspection and approval. The bonus is open to all inventors throughout the world, without distinction.

The bonus will be paid by the Government wholly or in part for any of the following benefits to be derived:

(1) A process of extracting and dressing the fiber of New Zealand hemp (*Phormium tenax*), whether by machinery or otherwise, whereby there shall be obtainable (*a*) a greatly improved quality of fiber marketable at a higher price, or (*b*) a substantial reduction in the cost of producing the fiber.

(2) Any such process that shall produce a fiber fit for use in manufactures other than rope and twine spinning.

(3) Any such process that shall render unnecessary any of the present operations involved in extracting and dressing the fiber, such as stripping, paddocking, or scutching.

(4) Any improved method of separating the green envelope of the flinty or colored matter from the green leaf of the phormium plant so as to produce a strong white fiber the whole of which can be saved with little or no tow or waste.

(5) Any means whereby the by-products obtained during the process of extracting and dressing New Zealand hemp fiber, such as the gum, dye, stripper slips, tow dust, or waste vegetable matter, shall be converted into a marketable commodity.[1]

The committee of the New Zealand Flax Millers' Association, on behalf of the New Zealand Government, will have charge of all competitions for the bonus. It is understood that the following considerations will be given particular attention in testing all machines, devices, or processes submitted to the committee: Cost of purchase, installation, and operation; labor and time

[1] From Vice-Consul-General Henry D. Baker's report, published in Daily Consular and Trade Reports, November 29, 1911, page 1075.

required; cost of turning out the fiber, tow, or any other product; percentage of fiber or tow (if any) produced from a given weight of fresh leaves; and the simplicity and durability of the working parts of the machine. Further particulars can be obtained by application to the president of the New Zealand Flax Millers' Association, Palmerston North, New Zealand. (*M. M. Saleeby.*)

DEVELOPMENT OF THE COPRA INDUSTRY.

As an evidence of how rapidly the copra industry is developing even in the "far ends of the earth," it is of interest to note that German New Guinea with the adjacent Bismark Archipelago is now exporting some 15,000 to 20,000 tons of copra annually. Only about one-quarter of this quantity, however, comes at present from European plantations; nevertheless, considering the fact that a large part of the European plantations are still very young, this proportion will probably reverse itself within a few years.

Papua, or British New Guinea, for the most part an unexplored wilderness, already exports about ₱75,000 worth of copra. Several experiment stations have recently been founded by the British Government and estates are springing up rapidly, even at a considerable distance from the coast. The new land is being planted in rubber and coconuts, a slight preference being given to the latter crop. The "natural" coconut groves belonging to the natives along the coast comprise some 150,000 hectares. There are also very extensive areas of sago palms which have, thus far, not been utilized to any great extent.

Even the Solomon Islands and the New Hebrides are now rapidly becoming copra-producing centers, and it may be noted that the most complicated copra-drying apparatus of which this Bureau has received information thus far is in use in the British section of the Solomon Islands. This, by the way, is a sad commentary upon the fact that in the Philippines, where at least one-third of the copra of the world is produced, there has been until just recently no modern smokeless drier of any style in operation. (*O. W. Barrett.*)

COPRA.

We learn from the Daily Consular and Trade Reports that a "large and well-known firm near Liverpool is spending, it is reported, 10 million pesos acquiring plantations in West Africa in anticipation of rising prices of copra."

It appears that commercial experts are now studying the

question of coconut-oil containers; up to the present no satisfactory drum, barrel, or tank has been devised for carrying crude coconut oil to market, but when such a package is perfected and offered the public, the copra industry will receive another impetus.

On every hand we meet with statements like the following:

> There are two methods of drying the broken coconut kernel to form the copra; one by sun drying, the other artificial. It is stated that the former is less effective than the latter, as the drying is often not sufficiently thorough, rot setting in during transportation from the producing center to the country of destination.

It is only a question of time now when the wholesale buyers will have to insist upon the raw product being thoroughly dried before shipment in the case of the copra, and of being well packed against leakage in the case of the oil: this means that smokeless artificial driers must be employed in the Philippines, or else that up-to-date coconut-oil factories to turn fresh nuts directly into oil be established—or *both.* (*O. W. Barrett.*)

THE WEST AFRICAN PALM-OIL INDUSTRY.

The palm-oil trade of tropical West Africa is now entering upon a new era of production due to improved methods in extraction. The price per ton of ordinary grade palm oil is about ₱300 delivered in the ports of Europe. This gives a profit of about 100 per cent to the oil merchant and this means that with the new machines for cracking the nuts and extracting the oil there will be a rather rapid increase in the profit percentages of the business, if not in the production itself.

It is said the hinterland of Liberia contains a practically unlimited amount of the oil palm but on account of the transportation difficulties the project has, thus far, remained undeveloped.

Recently a few attempts have been made to cultivate this palm in the river valleys of the Gulf of Guinea colonies and even in East Africa but it seems unwise to plant valuable land with a crop which needs only a few railways laid down into the hinterland of practically any country from Sierra Leone to the Kongo in order to bring the output up to a figure which will materially reduce the price. The output of palm oil in British West African Colonies alone now amounts to some 60 million liters, valued at not less than 11 million pesos; while the yearly export of palm kernels is some 226,000 tons valued at over 32 million pesos. These figures probably represent about one-half of the total output of these two commodities.

The point of all this is that coconut oil has a very serious rival, but because of the objectionable acids and other substances in the oil of the West African palm (*Elacis guineensis*) it is probable coconut oil will long continue as the more valuable product, at least in the line of human-food substances.

Both at the Singalong experiment station and in the Botanic Gardens of Manila, this palm has made a very vigorous growth and has fruited apparently as heavily as the descriptions of the palm in its wild state would indicate to be the normal yield. (*O. W. Barrett.*)

SUGAR-CANE CULTIVATION IN ZULULAND.

As an instance of what may be done in the line of sugar production under difficulties may be mentioned the fact that a giant syndicate is now said to be forming in England with a capital of some 25 million pesos with the object of erecting a large central on the Umfolosi Government concession in Zululand. This is remarkable not only from the fact that transportation is difficult in Zululand but also because the soil itself is comparatively poor and labor conditions are so bad that practically all of the plantation labor is performed by Tamil coolies imported from India.

If the Natal Government can straighten out a knot of difficulties like this and succeed, as she certainly has done for the past decade, in the sugar industry, it is still more surprising that the districts of the Philippines which are undeniably well adapted to sugar culture should remain practically undeveloped.

The variety of cane used in Zululand is, so far as the writer has observed from a brief tour through that country, entirely of the Japanese, or "Juba," variety. This cane is now growing at the Singalong experiment station but only as a forage crop; it appears to be decidedly inferior to most of the so-called "native Philippine" canes. (*O. W. Barrett.*)

CANE-SUGAR MILL.

The largest cane-sugar mill yet constructed has just been completed by a Scotch firm. This plant is for a German syndicate in Argentina and it is expected that 1,500 tons of cane can be handled daily. The fourteen rolls are "7 feet (2.13 meters) in length and 3 feet (91 millimeters) in diameter." These rolls work at a speed of some 7 meters per minute "under a pressure of $1\frac{3}{4}$ tons per square inch" from the hydraulic apparatus attached to the journals.

A mill like this should turn out some ₱20,000 worth of sugar per day, or 3 million pesos for the five months' grinding season. (*O. W. Barrett.*)

THE SAGO PALM.

The neighboring colony of British North Borneo exports some ₱120,000 worth of sago annually.

The Agusan Valley of Mindanao could undoubtedly export several times this amount from the vast swamps filled with the same species of sago palm which extend across the Sulu Archipelago into Borneo, and eastward to New Guinea. There is no doubt that some day these swamps will be the scene of great activity in the way of starch, sugar, and alcohol manufacture.

Sago flour, when properly prepared, is an excellent food, and by fermenting, alcohol can, of course, be made. Fortunately the sago palm reproduces itself from suckers as soon as the old plant is felled; but, unfortunately perhaps for the palm-sugar maker, it is a palm which dies at the time of flowering, like the cabo negro and buri.

Properly managed, a sago swamp would be continuously productive without replanting or cultivation of any kind; that is, the growing palms should be allowed to stand at the proper distances and all unnecessary suckers and useless intermediate trunks should be removed, allowing one or two strong suckers to grow from the base of each trunk as soon as it is ready for cutting. In fact, the sago may some day rival the nipa as a profitable palm crop, though it will never compare with the coconut. (*O. W. Barrett.*)

COFFEE BLIGHT IN THE PHILIPPINES.

The French Government has recently passed a law to prevent the spread of the coffee blight in the coffee-growing colonies of that country. Though it is not definitely known how this blight entered the Philippines, it is probable that it came in by way of the southern islands from Java or Singapore in the early eighties. This blight by 1885 or 1886 had spread throughout the great coffee-growing centers of Batangas and Laguna, and by 1890 the industry was practically destroyed.

If this terrible disease, which is known to science as *Hemileia vastatrix*, should gain entrance into Brazil, the price of coffee would probably be trebled within five years.

Had there been adequate measures and regulations, regarding the importation of plant material into the Philippines, in

operation at the time of the entrance of this fungus, it is believed many millions of pesos would have been saved to the coffee planters of Luzon. (*O. W. Barrett.*)

A NEW FORAGE GRASS.

The Bureau of Agriculture has just introduced a new forage grass from Abyssinia—the teff (*Eragrostis abyssinica*).

This grass is now extensively cultivated in the Transvaal and, to some extent, in the State of California. It has a very high feeding value and is said to be excellent for either cattle or horses.

There are two varieties, the red, which is more suited to growing in wet regions, and the white, which must be grown only during the dry season. Seed has been received from three countries—the Transvaal, France, and the United States. (*O. W. Barrett.*)

A MANGO CANNERY.

A plant to can mangos, litchis, pineapples, etc., has recently been erected at Muzaffarpur, about 350 miles from Calcutta on the East Indian Railway. It is said the canning methods are identical with those employed in California in the canning of freestone peaches; mangos are merely peeled and the pulp then sliced from the seed. Here in the Philippines where we have practically fiberless mangos, this industry should be a much simpler process, as far as removing the pulp from the seed goes, and furthermore, the quality of the canned article would certainly be superior, since the great objection to sliced mangos is, of course, the "fibrousness."

Hence, if the cannery in India is a success it should be a still better proposition here in the Philippines, once the mango industry is established—that is, once we can boast of a modern orchard of mango trees, every individual of which bears a full crop at least once every twelve months. The Carabao variety would leave little to be desired by the cannery man. (*O. W. Barrett.*)

NATURAL CITRUS HYBRIDS.

The investigations recently undertaken by the horticulturist of this Bureau indicate that numerous and interesting hybrids exist naturally among the citrus fruits throughout the Archipelago. The work of gathering together the economic forms of all these supposedly noncommercial types of citrus fruits will require considerable time and is a rather tedious task.

Great interest has been taken during recent years in the

study of rare citrus fruits by the United States Department of Agriculture, and recently Sig. L. Cabistano and A. Parozzani have studied the natural hybrids in Sicily. They find that out of "some 200 varieties of citrus fruits having standard recognition among horticulturists, there are more than thirty true hybrids, most of which have been produced without the aid of man." The authors maintain that "The frequency of natural hybrids among citruses is due to the great affinity (morphological and constitutional) existing between the different species, and to the abundant flowering, which in some species (lemons) is continuous and very rich in nectar. Hence, numerous visits by insects, particularly bees." The authors also find a surprising amount of variation in the chemical analysis of natural citrus hybrids, and furthermore, they seem to believe that there is a potential tendency to instability or variability in each individual tree and that, on this account, horticultural work with seedlings of these natural hybrids is exceedingly difficult and should not be attempted by the commercial planter. In other words, the producer of oranges, limes, lemons, etc., should rely *entirely* upon stock budded with standard varieties of these fruits. (*O. W. Barrett.*)

NEW BREEDS OF CATTLE.

After a century of cattle breeding in the Island of Jamaica it is concluded that cross-bred types with Zebu blood as the principal element are unquestionably the best for general purposes, that is, for draft and beef. The Mysore hybrids have proved to be the best draft animals, with the possible exception of the Gugerats, which are of larger size but somewhat intractable in the hands of an ordinary laborer. The Nellore is considered slightly inferior to the other Zebu breeds. The finest cattle ever seen in Jamaica were the crosses from Hissar-bred Harriana bulls.

The writer considers the Zebu hybrids, as raised in the "pens," or large estates, in the interior of Jamaica, to be the best specimens of cattle, everything considered, he has ever seen either in the Tropics of both Hemispheres, or in the Temperate Zone; they keep sleek and fat in low-grade pasturage and, according to popular belief at least, can subsist on browse instead of grass, during the dry season.

A most interesting fact has recently come to light through some experiments the German Government has been making with various breeds and species of bovine animals collected in all parts of the world: it is found that by crossing gayal bulls

from Assam with cows of the ordinary German breeds a distinctly new race of animals is produced, the cows of which give "30 per cent more butter fat in their milk than ordinary cows, this increased fat value continuing for several generations." The gayal is the partially domesticated form of the exceedingly wild and intractable gaur of the jungles of northern Assam and western Siam.

This fact serves to illustrate the crying need for scientific breeding experiments in the line of cattle raising, and in fact, in all lines of animal husbandry and thremmatology.

Professor Ewart of England has shown the world that it is possible to make a score or more of hybrids between the various species of the genus Equus and it appears that the German Government is soon to rank foremost among the nations as a producer of bovine hybrids. (*O. W. Barrett.*)

MONTHLY CROP CONDITIONS—JANUARY, FEBRUARY, AND MARCH.

ABACA.

Albay.—The drought in the Legaspi-Libon districts still holds, and agricultural conditions in that part of the province show no improvement; abacá is drying up; small crops are planted in some parts where irrigation is available. The latest quotation on the fiber is only ₱11 per 100 kilos.

Ambos Camarines.—A considerable number of the growing plants are suffering from extreme heat and lack of moisture.

Leyte.—In January the price of hemp went up a trifle, ₱12.50 being paid in Carigara per 63.25 kilos. Improvement in the price of abacá has served to give tone to the general commercial conditions in this section.

Misamis.—In January a great deal of abacá of good quality was brought into Cagayan and other towns, and it is believed that the abacá industry, which seemed to be falling off on account of the low prices, is reviving.

Samar.—Considerable abacá was sent in during the past month from the municipalities on the west coast where most of the hemp of the province is produced. In the northern and northeastern sections the planting of rice interfered with the hemp business and in the southern section the gathering of copra had the same effect.

COCONUTS.

Albay.—Coconuts have suffered considerably from the continued dry weather.

Ambos Camarines.—The coconut crop has been unusually heavy and is worth far more than our best rice crops.

Cebu.—Coconuts do not seem to have suffered from the drought to the same extent as some of the other staple crops.

Laguna.—Since the opening up of the railroad into the coconut districts several barrios have become large shipping points for copra; this is especially true of Mojon, Nagcarlan.

Leyte.—The improvement in the price of copra in January served to better the general conditions in this section.

Moro.—In Cotabato about 5,000 coconut trees were planted during the month of January, and about the same number during the month of February. In Zamboanga the coconut plantations are badly in need of rain, and in but one instance is there a possibility of irrigation.

Samar.—In the southern part of the province considerable copra is being shipped in, and the prospects are that the exportations of copra will increase monthly for the next six months. In the northeastern section the indications are that after the rice season a great deal of copra will be exported.

Tayabas.—The copra crop is still very small on account of continued dry weather; the price, however, still holds high throughout the province.

CORN.

Cebu.—Except in some mountain sections where there has been a little rain the corn crop is very poor. Along the coasts, many fields were not planted because of lack of rain. The price is high with every probability of a continued rise; unless there is sufficient rain to plant corn in April, there will probably be a rather severe famine in the province.

Ilocos Norte.—The standing crop of corn is in very good condition though it is now in need of rain. Should the dry weather continue for another month some damage will be done.

Ilocos Sur.—A large amount of corn was planted but suffered somewhat for want of moisture. The harvest is now over and most of the people are planting a second crop.

Iloilo.—Less corn than usual was planted this year, and some land has already been prepared for planting as soon as the first rains come.

Isabela.—There will be a good corn crop this year in the towns of Gamu, Naguilian, Cauayan, Angadanan, and Echague. In the towns north of Gamu very little corn will be harvested owing to the drought and the late planting of this crop.

Laguna.—The districts of Baggao, Piat, and Tuao have a full crop of corn. The people of Baggao have doubled their corn acreage, and it is estimated that the present crop will be about 20 per cent over that of last year.

Leyte.—The corn crop this year has not come up to expectations being fully one-third less than was anticipated. In the middle section of the province the people are preparing the soil for a large crop of this staple.

Occidental Negros.—Although some corn has been planted, the indications are that there will be more or less hunger among the poorer classes during the coming year. The corn crop in San Carlos, Escalante, and Sagay is very poor.

Oriental Negros.—Almost all the corn has been harvested in the north and in spite of the dry weather the price remains normal.

RICE.

Capiz.—The price of rice and palay is still high in the province, the former being quoted at ₱7.50, the latter at ₱3.60.

Ilocos Norte.—The palay crop has been harvested and is of good weight and quality.

Ilocos Sur.—The recent rice crop was hardly 50 per cent of that of last year.

Iloilo.—The price of rice is going up and considerable scarcity of this staple is looked for in the near future.

La Union.—The palay crop was discouraging, and the price of rice is from ₱8 to ₱8.50 per 75 liters.

Nueva Ecija.—The rice crop, while very poor, was not as bad as anticipated. Considerable inconvenience, but no suffering, was caused by the recent ten days' quarantine.

Occidental Negros.—The shortage in the palay crop is greater than as first reported. The price of rice is on the increase.

Pampanga.—The rice crop has been harvested, but there is very little palay on the market, as those that have been fortunate enough to get a fair crop are holding it for a rise in price.

Tarlac.—This season, owing to the splendid crop of sugar cane, the province has not suffered to any great extent from the rice shortage. As soon as the northern half of the province can increase its sugar-cane acreage, rice failures will have, comparatively speaking, but little effect.

Tayabas.—Rice is still scarce and getting more so every day, though some relief has been had from the rice shipped in by the Government.

SUGAR CANE.

Cebu.—The farmers in different sections of the province estimate the loss in the sugar harvest from drought at from 25 to 50 per cent. The ratoon growth and new plantings have been injured very much from lack of sufficient moisture. The sugar harvest has been finished in most sections, though there are a few isolated fields that have not yet been cut.

Ilocos Norte.—The standing crop of sugar cane is in very good condition, although it is now in need of rain.

Ilocos Sur.—Sugar cane is still being harvested all over the province; the yield is fair.

Iloilo.—Due to the dry weather not as much cane was planted as farmers wished to put in. However, that which was planted early in the season is looking very well, especially in the Concepción district where there has been some rain.

Occidental Negros.—If the drought continues the sugar production for the next season will be very small.

Oriental Negros.—Sugar has not done as well as in previous years, though a greater amount of sugar will be exported this year due to the greater amount of cane planted. If the high prices continue to hold the planters will make money notwithstanding the generally poor crops.

Tarlac.—The sugar cane acreage is larger this year than in any previous years. New mills are constantly being installed, and within the course of a few years, if prices keep up, sugar will be the leading product of the province. Owing to the splendid crop of this year the province has suffered but little from the rice shortage.

TOBACCO.

Cagayan.—It is estimated that the tobacco crop in the Tuguegarao district will be about one-fifth of that of former years; in the Itaves district tobacco is in good condition and about the usual crop will be harvested; in the Alcala, Amulung, and Iguig districts the crop is in fair condition; in the Baggao district nearly the usual crop will be harvested.

Cebu.—In common with other crops, tobacco has been rather severely injured by the drought.

Ilocos Norte.—The tobacco planted is in good condition and promises a better crop than last year, although it is in need of a little rain.

Ilocos Sur.—Considerable tobacco has been planted and from all appearances the young plants are doing well. Harvesting is going on in Abra, and the crop is fair.

Iloilo.—Tobacco bids fair to give a good yield.

Isabela.—In the towns of Echague, Angadanan, Cauayan, Naguilian, and Gamu, the tobacco planted in the month of December is growing finely and promises a fair crop with quality superior to that of last year. The crop planted in January in the same

section is dwarfed in size and poor in quality. The tobacco in the towns of Ilagan, Tumauini, Cabagan Nuevo, San Pablo, and Santa Maria presents a bad appearance for lack of rain, and the farmers state that unless there is rain very soon this crop will be a complete failure. The farmers have commenced gathering their tobacco crop in the southern part of the province.

La Union.—The tobacco crop will probably be only slightly affected by drought.

Occidental Negros.—The tobacco crop in the San Carlos, Escalante, and Sagay sections is very poor.

STATISTICS ON PRINCIPAL PHILIPPINE CROPS FOR THE QUARTER ENDING SEPTEMBER 30, 1911.

[Compiled from the official reports submitted by the executive officers of 1 city, 716 municipalities, 80 townships, 22 rancherias, and 7 settlements.]

By BENJ. P. LUKENS, *Statistician.*

RICE.

(Unhulled rice locally called "palay.")

Provinces.	Condition of crop.	Area under cultivation.	Area harvested.	Quantity harvested.		Market price per 75 liters.	
				Liters.	Equivalent in cavans.	Highest.	Lowest.
		Hectares.	*Hectares.*				
Agusan	Fair	512					
Albay	Fair	10,801	284	205,788	2,743.84	₱4.00	₱2.57
Ambos Camarines	Fair	14,651	506	140,366	1,871.55	5.25	3.00
Antique	Good	27,010	845	1,006,908	13,425.44	4.50	2.25
Bataan	Fair	9,179				5.00	3.00
Batanes	Poor	17	1	225	3.00		
Batangas	Poor	25,170	10,073	4,621,425	61,619.00	4.00	2.25
Bohol	Poor	14,645	210	20,425	272.34	4.50	3.00
Bulacan	Fair	55,767	25	15,000	200.00	4.00	3.50
Cagayan	Good	13,753	2,311	4,248,000	56,640.00	3.75	2.60
Capiz	Fair	53,575	6,856	10,424,406	138,992.00	4.50	3.00
Cavite	Fair	23,300	4,089	2,387,450	31,832.67	4.12	2.75
Cebu	Fair	3,732	796	626,531	8,353.75	4.50	3.00
Ilocos Norte	Poor	47,430	1,600	12,000	160.00	3.75	2.50
Ilocos Sur	Poor	42,942	1,460	58,003	773.38	5.00	2.62
Iloilo	Good	80,096	3,719	1,430,800	19,077.34	4.20	3.00
Isabela	Poor	1,405	1,152	46,800	624.00		
La Laguna	Fair	9,662	1,126	1,369,200	18,256.00	4.50	3.40
La Union	Poor	24,184	2,723			5.00	3.75
Leyte	Good	16,274	996	243,850	3,251.34	3.75	3.00
Mindoro	Fair	4,233	237	87,340	1,164.54	3.00	3.00
Misamis	Fair	7,815				4.50	4.00
Moro	Fair	7,655	198	274,500	3,660.00	4.00	3.00
Mountain	Fair	11,170	781	273,888	3,651.85	4.00	2.25
Nueva Ecija	Poor	76,001				3.75	2.50
Nueva Vizcaya	Fair	4,064					
Occidental Negros	Fair	20,969	900	533,500	7,113.34	3.75	3.00
Oriental Negros	Fair	2,966	347	260,625	3,475.00	5.25	3.75
Palawan	Fair	13,394	1,598	1,487,650	19,835.34	4.00	1.50
Pampanga	Poor	46,703	12,603			4.50	2.90
Pangasinan	Poor	184,832	15,128	125,850	1,678.00	5.00	3.12
Rizal	Fair	17,340	202	289,500	3,860.00	4.50	3.00
Samar	Poor	6,072	898	590,195	7,869.27	3.75	3.00
Sorsogon	Fair	1,952	145	150,087	2,001.16	4.50	3.75
Surigao							
Tarlac	Fair	73,213	4,359	3,629,095	48,387.94	3.75	1.50
Tayabas	Poor	19,221	387	37,500	500.00	4.50	3.37
Zambales	Poor	18,988	58	15,750	210.00	3.75	2.40
Total		990,693	76,613	34,612,657	461,502.09		

NOTE.—

1 hectare equals 2.471 acres (English) or 0.3577 quiñon (Spanish).
1 liter equals 0.908077 dry quart or 0.28377 bushel.
1 cavan equals 75 liters.
1 kilo equals 2.20462 English pounds or 2.174 Spanish pounds.
₱1 (Philippine currency) equals $0.50 (United States currency).
1 cavan of "palay" averages 43 kilos in weight and cleans at about 65.12% producing an average of 28 kilos of "arroz" (cleaned rice).
2.05357 cavans of "palay" (average) produce 1 cavan of "arroz" which averages 57.5 kilos in weight.
On account of numerous floods the number of hectares harvested and the production per hectare have been exceedingly small. This is especially noticeable in the provinces located on the Island of Luzon. Two of these provinces (La Union and Pampanga) have reported that their rice crop for this quarter is a total loss.

CORN.

(Shelled corn locally called "maiz desgranado.")

Provinces.	Condition of crop.	Area under cultivation.	Area harvested.	Quantity harvested.		Market price per 75 liters.	
				Liters.	Equivalent in cavans.	Highest.	Lowest.
		Hectares.	*Hectares.*				
Agusan	Good	108	50	83,250	1,110.00	₱4.50	₱2.75
Albay	Fair	1,347	437	117,327	1,564.36	3.75	2.57
Ambos Camarines	Fair	431	241	166,459	2,219.45	3.75	1.50
Antique	Fair	779	779	354,140	4,721.87	3.00	2.25
Bataan	Poor	186	156	19,650	262.00	4.00	3.75
Batanes	Poor	6	3	1,350	18.00	3.00	3.00
Batangas	Poor	6,821	6,811	833,250	11,110.00	4.50	2.25
Bohol	Fair	9,342	5,809	3,345,526	44,607.01	5.00	3.00
Bulacan	Poor	2,351	2,284	376,300	5,017.33	4.00	3.00
Cagayan	Poor	14,351	14,301	4,177,510	55,700.13	4.50	2.00
Capiz	Fair	1,353	1,161	443,275	5,910.33	3.75	2.50
Cavite	Fair	1,035	1,020	511,250	6,816.67	5.25	2.25
Cebu	Fair	89,396	55,072	52,917,245	705,563.27	4.50	3.00
Ilocos Norte	Fair	2,091	2,005	2,256,886	30,091.81	3.75	2.00
Ilocos Sur	Poor	2,050	2,037	629,261	8,390.15	5.00	2.25
Iloilo	Poor	2,198	2,168	689,936	9,199.15	3.75	2.25
Isabela	Fair	13,791	9,604	3,298,050	43,974.00	5.25	2.40
La Laguna	Fair	469	374	412,776	5,503.68	3.75	2.25
La Union	Poor	1,221	967	217,708	2,902.77	4.50	2.50
Leyte	Fair	8,485	5,491	4,374,942	58,332.56	4.50	2.25
Mindoro	Poor	196	123	76,565	1,020.87	3.00	2.25
Misamis	Fair	5,508	4,987	6,310,025	84,133.67	4.50	3.00
Moro	Good	406	290	208,500	2,780.00	4.50	2.25
Mountain	Fair	887	885	469,246	6,256.61	5.25	2.50
Nueva Ecija	Fair	947	896	486,041	6,480.55	3.75	2.25
Nueva Vizcaya	Fair	108	95	68,050	907.33	3.75	2.00
Occidental Negros	Poor	7,896	5,386	2,517,050	33,560.67	4.50	3.00
Oriental Negros	Fair	15,509	12,877	5,453,374	72,711.65	5.00	3.00
Palawan	Fair	321	238	155,550	2,074.00	5.00	1.50
Pampanga	Fair	4,037	3,017	367,844	4,904.58	5.25	2.25
Pangasinan	Poor	10,700	10,603	1,463,126	19,508.35	4.50	2.25
Rizal	Good	1,311	1,183	717,767	9,570.23	3.75	2.25
Samar	Fair	1,684	1,305	400,423	5,338.97	4.50	2.25
Sorsogon	Good	1,263	900	340,609	4,541.45	4.50	3.00
Surigao	Fair	3,169	325	186,500	2,486.67	3.00	2.25
Tarlac	Poor	991	339	95,150	1,268.67	3.00	1.50
Tayabas	Fair	281	261	42,275	563.67	5.00	3.00
Zambales	Good	159	159	103,675	1,382.33	4.00	3.00
Total		213,184	154,639	94,687,861	1,262,504.81		

NOTE.—

1 hectare equals 2.471 acres (English) or 0.3577 quiñon (Spanish).
1 liter equals 0.908077 dry quart or 0.028377 bushel.
1 cavan equals 75 liters.
1 kilo equals 2.20462 English pounds or 2.174 Spanish pounds.
₱1 (Philippine currency) equals $0.50 (United States currency).
1 liter of shelled corn averages 0.78 kilo in weight.
1 cavan of shelled corn averages 58.5 kilos in weight.
1 cavan of corn on cob averages 30 kilos in weight and shells at about 79 per cent producing an average of 23.7 kilos of shelled corn.
2.46835443 cavans of corn on cob (average) produce 1 cavan of shelled corn.
200 ears of corn is the average number which will fill 1 cavan of corn on cob.
0.15 kilo is the average weight of one ear of corn.
On account of numerous floods the number of hectares harvested and the production per hectare have been small.

ABACA.

(Philippine hemp.)

Provinces.	Condition of crop.	Area under cultivation.	Area harvested.	Quantity harvested.		Market price per 63.25 kilos.	
				Kilos.	Equivalent in piculs.	Highest.	Lowest.
		Hectares.	*Hectares.*				
Agusan	Fair	2,880	920	214,050	3,384.19	₱9.48	₱6.32
Albay	Fair	112,713	35,095	9,115,253	144,114.67	8.85	6.00
Ambos Camarines	Fair	100,653	20,634	2,430,246	38,422.86	7.59	4.40
Antique	Fair	1,143	72	8,064	127.49	15.00	12.00
Bataan							
Batanes							
Batangas	Fair	748	245	184,686	2,919.94	13.91	7.59
Bohol	Fair	2,141	454	125,522	1,984.54	10.00	6.32
Bulacan							
Cagayan							
Capiz	Fair	5,720	952	193,817	3,064.30	17.00	6.95
Cavite	Good	3,684	800	328,301	5,190.53		
Cebu	Good	8,015	1,291	375,053	5,929.69	13.91	7.59
Ilocos Norte							
Ilocos Sur							
Iloilo	Good	2,802	682	170,978	2,703.21	16.44	12.65
Isabela							
La Laguna	Good	2,561	1,025	294,793	4,660.76	9.48	6.32
La Union							
Leyte	Fair	65,592	14,257	3,922,803	62,020.60	12.65	7.59
Mindoro	Fair	1,613	632	151,171	2,390.06		
Misamis	Fair	18,062	3,783	1,092,018	17,265.11	7.00	5.50
Moro	Fair	6,075	1,069	396,392	6,267.06	13.91	5.25
Mountain							
Nueva Ecija							
Nueva Vizcaya							
Occidental Negros	Fair	3,698	1,116	88,475	1,398.81	16.00	7.59
Oriental Negros	Fair	4,768	758	237,866	3,760.73	10.75	6.32
Palawan							
Pampanga							
Pangasinan							
Rizal							
Samar	Good	27,343	6,456	2,265,790	35,822.77	12.65	5.69
Sorsogon	Good	73,378	17,557	3,267,332	51,657.42	13.28	4.42
Surigao	Good	7,103	1,902	671,210	10,612.02	11.38	6.32
Tarlac							
Tayabas	Good	8,388	4,080	581,458	9,193.01	9.48	5.69
Zambales							
Total		458,880	113,780	26,115,278	412,889.77		

NOTE.—
1 hectare equals 2.471 acres (English) or 0.3577 quiñon (Spanish).
1 kilo equals 2.20462 English pounds or 2.174 Spanish pounds.
1 picul equals 63.25 kilos.
₱1 (Philippine currency) equals $0.50 (United States currency).

TOBACCO.

NOTE.—No tobacco was harvested during this quarter.

SUGAR CANE.

Provinces.	Condition of crop.	Area under cultivation.	Area harvested.	Quantity harvested (in marketable form). Crude sugar.	Panochas.	Basi.	Market price. Crude sugar per 63.25 kilos. Highest.	Lowest.	Panochas per 63.25 kilos. Highest.	Lowest.
		Hectares.	*Hectares.*	*Kilos.*	*Kilos.*	*Liters.*				
Agusan										
Albay	Fair	443	163		70,582	30			₱10.12	₱6.32
Ambos Camarines	Fair	740	231		82,314				12.65	3.80
Antique	Good	2,111								
Bataan	Fair	123					₱7.59	₱6.00		
Batanes										
Batangas	Fair	8,422								
Bohol	Fair	790	102	11,400	62,045				11.38	5.06
Bulacan	Fair	4,236	13			2,000	9.48	7.59		
Cagayan	Good	109	26		2,024	28,126				
Capiz	Good	1,721	132		71,557		5.06	4.43	7.59	5.69
Cavite	Fair	1,866					11.38	6.32		
Cebu	Fair	4,575	255	324,296	42,254		7.59	5.06	7.59	3.16
Ilocos Norte	Fair	3,227								
Ilocos Sur	Fair	5,160							12.65	4.00
Iloilo	Good	6,458	471	407,766			9.00	6.95		
Isabela	Fair	14								
La Laguna	Fair	2,310	10		2,580		12.65	4.43	12.65	5.06
La Union	Fair	898								
Leyte	Fair	1,028	307		172,060				9.48	5.06
Mindoro	Good	17	13		12,568					
Misamis	Fair	54	6	160	4,071					
Moro	Good	662	83		76,186				9.00	5.06
Mountain	Fair	224	10		150	8,550	6.00	4.45	5.69	5.00
Nueva Ecija	Good	1,146					7.59	4.43	7.50	5.00
Nueva Vizcaya	Fair	120	54		69,019	4,824			12.65	7.59
Occidental Negros	Fair	37,001	1,200	2,122,332			9.48	5.69		
Oriental Negros	Good	2,216	211	337,287	126		9.48	7.59		
Palawan										
Pampanga	Fair	26,536					8.22	5.06		
Pangasinan	Good	3,938	6	90	20	15	12.65	6.32	7.00	3.00
Rizal	Fair	2,207								
Samar	Good	1,103	315		319,618				12.65	6.32
Sorsogon	Fair	711	355		201,539				9.48	3.79
Surigao	Good	138	36		22,643				9.48	6.32
Tarlac	Fair	8,820					9.00	5.69		
Tayabas	Good	1,210	151	9,000	64,549				12.65	6.32
Zambales	Fair	216							12.65	6.32
Total		130,550	4,150	3,212,331	1,275,905	43,745				

NOTE.—
1 hectare equals 2.471 acres (English) or 0.3577 quiñon (Spanish).
1 kilo equals 2.20462 English pounds or 2.174 Spanish pounds.
1 liter equals 1.0567 liquid quarts or 0.26417 gallon.
1 picul equals 63.25 kilos.
₱1 (Philippine currency) equals $0.50 (United States currency).
Crude sugar is usually handled in bell-shaped earthen shells called "pilones" or in buri sacks called "bayones."
Panochas are small cakes of unrefined sugar varying from half a kilo to one kilo in weight.
Basi is a beverage produced from the juice of sugar cane.
This quarter is not the usual season for harvesting sugar in those provinces where sugar cane is a principal crop.

COCONUTS.

Provinces.	Condition of crop.	Total number of trees.	Total nuts gathered.	Nuts consumed for food.	Marketable products.			Market price.					
					Copra.	Oil.	Tuba.	Nuts per 100.		Copra per 63.25 kilos.		Oil per liter.	
								Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
					Kilos.	*Liters.*	*Liters.*						
Agusan	Fair	12,880	47,200	4,800	9,000	20	800	₱2.00	₱2.00	₱8.85	₱8.85		
Albay	Fair	3,312,948	17,271,459	2,763,594	3,238,119	72,922	373,792	5.00	2.00	11.38	6.32	₱0.45	₱0.12
Ambos Camarines	Fair	1,900,671	5,854,451	939,369	1,078,645	18,840	113,841	4.00	2.00	9.48	6.32	.40	.15
Antique	Fair	485,281	461,556	39,110	22,600	6,771	151,706	3.00	2.00	9.48	7.59		
Bataan	Fair	27,653	8,900	8,900									
Batanes	Poor	16,154	16,700	16,700				4.00	3.00				
Batangas	Fair	238,063	112,900	32,900	16,105			5.00	2.00				
Bohol	Good	1,828,819	4,803,377	929,615	936,779	16,541	1,668,608	3.00	2.00	11.38	8.22	.30	.25
Bulacan	Good	5,180	11,175	11,175									
Cagayan	Fair	47,869	242,894	242,894									
Capiz	Fair	3,386,497	3,020,979	190,335	586,659	26,426	453,478	5.00	2.00	9.48	6.00	.37	.10
Cavite	Fair	67,382	25,200	25,200									
Cebu	Good	3,277,948	10,430,469	1,149,100	1,767,143	205,248	2,078,992	4.00	2.00	11.38	5.06	.40	.15
Ilocos Norte	Fair	25,981	14,200	14,200									
Ilocos Sur	Fair	88,183	52,220	52,220									
Iloilo	Good	1,264,036	1,113,208	323,071	144,986	8,553	822,113	4.00	2.00	12.00	8.22	.25	.20
Isabela													
La Laguna	Fair	5,280,703	18,206,210	2,998,745	1,783,389	656,200	243,435	3.00	2.00	10.12	6.95	.37	.20
La Union	Fair	121,870	324,765	157,780	38,508	1,166		4.00	3.00	8.85	5.06	.35	.25
Leyte	Good	1,682,681	10,104,062	2,704,909	1,468,668	33,629	1,685,852	4.00	3.00	11.38	5.06	.40	.17
Mindoro	Good	284,879	99,685	45,785	12,700	100	10,999	5.00	3.00	7.59	6.00	.20	.15
Misamis	Good	1,908,956	9,861,275	18,530	2,081,724	1,350	122,110	4.00	2.00	11.38	5.00		
Moro	Good	1,442,456	4,477,664	187,380	1,021,068	4,300	176,135	5.00	3.00	10.45	6.95	.40	.20
Mountain	Poor	10,972	10,406	2,324	2,024	90		5.00	2.00				
Nueva Ecija	Fair	10,636	18,692	18,692				6.00	4.00				
Nueva Vizcaya	Fair	4,794	1,565	1,565									
Occidental Negros	Good	846,802	1,549,286	282,220	312,945	4,331	935,718	4.00	2.00	12.00	6.32	.50	.30
Oriental Negros	Good	1,340,742	5,658,515	483,231	1,005,387	147	520,295	3.00	2.00	10.75	7.59		
Palawan	Fair	204,980	677,813	209,900	89,044		283,960	2.00	1.00	7.59	5.06		
Pampanga													
Pangasinan	Good	1,699,584	1,485,118	1,196,469	141,756	38,185	900	5.00	3.00	11.38	5.06	.50	.20
Rizal													
Samar	Good	4,620,885	17,680,532	1,345,189	3,205,128	36,227	320,216	5.00	2.00	9.00	6.32		
Sorsogon	Fair	1,631,246	2,518,478	250,901	573,980	1,973	128,277	4.00	2.00	10.12	4.42	.40	.20
Surigao	Good	483,250	1,124,976	71,173	225,834	668	225,518	3.00	2.00	10.12	8.22		
Tarlac	Fair	13,745	3,712	3,712									

Tayabas	Good	5, 975, 273	31, 267, 615	645, 200	7, 535, 523	5, 867	222, 187	5.00	2.00	9.48	4.43
Zambales	Fair	141, 055	184, 140	176, 140	2, 024						
Total		43, 691, 054	158, 741, 397	17, 543, 028	27, 299, 738	1, 139, 554	10, 538, 932				

NOTE.—
1 kilo equals 2.20462 English pounds or 2.174 Spanish pounds.
1 liter equals 1.0567 liquid quarts or 0.26417 gallon.
1 picul equals 63.25 kilos.
₱1 (Philippine currency) equals $0.50 (United States currency).
If the average distance between coconut trees be considered as 7.07 meters (23.2 feet) the number of trees per hectare would be 200 and the area under cultivation for this quarter would be 278,542.6 hectares.
In the above stated number of trees all classes of coconut trees are included, whether they be bearing, nonbearing, or producing tuba.
During this quarter great damage was done to coconuts by numerous severe storms. Consequently the production is lighter than usual.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS—MARCH.

By the INSULAR COLLECTOR OF CUSTOMS.

[Values in dollars United States currency.]

IMPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Total.
Rice	Kilos	14, 130, 160	2, 540, 617	4, 143, 141	20, 813, 918
	Value	606, 380	79, 958	170, 778	857, 116
Beef cattle	Number	1, 724			1, 724
	Value	36, 887			36, 887
Sugar	Kilos	450, 668	23, 716	21, 443	495, 827
	Value	32, 308	2, 016	1, 648	35, 972
Coffee	Kilos	97, 586	546	1, 368	99, 500
	Value	36, 200	184	455	36, 839
Cacao	Kilos	171, 200	21, 985	1, 333	194, 518
	Value	56, 968	7, 121	395	64, 484
Eggs	Dozen	381, 012		167	381, 179
	Value	32, 669		23	32, 692
Raw cotton	Kilos	27, 627			27, 627
	Value	7, 045			7, 045

EXPORTS.

Articles.		Manila.	Cebu.	Iloilo.	Total.
Hemp	Kilos	9, 471, 875	1, 364, 302		10, 836, 177
	Value	1, 033, 342	156, 167		1, 189, 509
Sugar	Kilos	5, 508, 102	179	12, 291, 314	17, 799, 595
	Value	325, 541	9	759, 600	1, 085, 150
Copra	Kilos	7, 509, 766	3, 781, 608	605, 908	11, 897, 282
	Value	331, 796	358, 520	55, 200	1, 145, 516
Cigars	Number	14, 305, 806			14, 305, 806
	Value	216, 619			216, 619
Cigarettes	Number	3, 065, 850			3, 065, 850
	Value	3, 056			3, 056
Tobacco	Kilos	1, 058, 012			1, 058, 012
	Value	177, 859			177, 859

PLATE I.—IRRIGATED BANANA FIELD AT THE LAMAO EXPERIMENT STATION, BATAAN.

HORTICULTURAL NUMBER

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CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

HORTICULTURE IN THE PHILIPPINES.

By the DIRECTOR OF AGRICULTURE.

In following out the plan adopted some time since of having every other number of the REVIEW devoted to some one subject, there has arisen such a wealth of material on many subjects that there is every indication that it will be necessary to have such special numbers occur even more frequently than had been at first planned. The present number was at first intended to include all of the phases of horticulture, but it has become necessary to hold over some of the material which will serve as a basis for a number devoted to trees and ornamental plants which may be used for planting in the Philippines. This number, therefore, is devoted to the fruits and vegetables exclusively.

There are few places in the world where may be grown in greater variety fruits which add so materially to the daily food supply. If every owner of even a small area of land would plant a few trees of some of the species described in this number, the results would be so satisfactory and the object lesson so good that the present comparatively meager supply of fruits in the Islands would be greatly increased. Land owners should bear in mind that it is usually possible to plant a few fruit trees without in any way interfering with the general cultivable area. The trees may be planted about the house and buildings and on the margins of land in such a way as to be not only useful but ornamental and at the same time provide without any additional expense a considerable supply of palatable and attractive food. Too little thought is usually given to the actual food value of fruit. Inhabitants of the Philippines think first of rice, and frequently second of the same crop when considering the food supply. The present prolonged drought emphasizes very strongly the desirability, and it might be said the necessity, of something in addition to rice which is not so subject to the ill effects from drought as are the ordinary farm crops. Nothing supplies this need so thoroughly as trees which root deeply enough to be in a considerable degree independent of the variation in water supply. It is for these reasons that the Bureau is continually urging through every possible channel the planting of fruit trees, and that fruits be considered as not only a desirable but a *necessary* portion of the food supply.

THE PRESENT STATUS OF HORTICULTURE IN THE PHILIPPINES AND ITS OUTLOOK FOR THE FUTURE.

By P. J. WESTER, *Horticulturist.*

Comparatively few years ago horticulture, even in countries where civilization is most highly developed, was considered to be an industry of subordinate importance in comparison with other industries such as agriculture, animal husbandry, mining, etc., and in many the word horticulture itself was a misnomer according to our present understanding of this term. It is scarcely astonishing then that horticulture, the most advanced stage in the cultivation of plants by man, is not farther advanced in the Philippines where certain folktribes are still uncivilized and where every stimulating influence in this direction has been absent until of late.

Since the American occupation of the Philippines, the interest in better horticultural products has grown, almost imperceptibly at first, but steadily, if slowly, as shown by the increasing volume of letters of inquiry and requests for seeds received by the Bureau, and by the better quality of many vegetables now offered in the Manila markets as compared with those of the early days. Mistakes and wasted efforts, which occurred in those times, have been corrected and the organization of the Bureau of Agriculture, now more closely than ever identified with the development of the plant industries of the Archipelago, has been strengthened and perfected. Seeds of improved varieties of vegetables have been imported and distributed in large quantities. So far nothing has been accomplished in the improvement of the vegetables that were already cultivated here before the insurrection against Spain, but since the organization of the present form of Government nearly all varieties of vegetables characteristic of the civilization of the Occident, not already brought here by the Spaniards, have been introduced, as well as better varieties of all. Perhaps the greatest single, or rather double, influence for the encouragement of the cultivation

of better vegetables for home use has been the large annual distribution of vegetable seeds by the Bureaus of Agriculture and Education, coupled with the recently-instituted school gardens of the Bureau of Education, which, rightly managed, should prove an immense force in developing horticulture in the Philippines. Notwithstanding these efforts in the past to elevate Philippine horticulture this science is, however, still in its infancy, and only a comparatively limited percentage of the total population have learned to appreciate the advantages of a home garden of more than a few native vegetables. The markets of the centers of population in the Philippines are not satisfactorily supplied with home-grown vegetables and fruits of good quality, and considerable quantities are imported from China and other countries, as may be seen from the figures quoted on another page.

Among the vegetables grown in the Philippines, there are a number of species of tropical origin, usually referred to as "native vegetables," for instance, the apalia, batao, seguidilla, pacupis, and gabi that are practically unknown to European and American horticulture; while the melon, squash, eggplant, camote, tomato, and many other vegetables introduced by the Spaniards, were grown in the Philippines before the advent of the Americans. The quality of most of the varieties of the latter class leaves much to be desired, however, partly perhaps on account of general ignorance of the importance of care in the selection and saving of seed among the population; in part the inferior quality is undoubtedly due to the deterioration in consequence of the climatic conditions in the Philippines. Some of the "native vegetables," such as the apalia, possess qualities, that, while relished by a people knowing them from childhood, make them repellent to the Caucasian and, in fact, are of little value; others, such as the gabi, camote, ube, seguidilla (see Plate IV) and libato are wholesome, nourishing and appetizing when they are properly prepared. The camote, cassava and ube are perhaps destined to play a greater rôle in the life of the people than any that may be yet introduced into the Philippines. As the population becomes better educated and begins to learn to discriminate, we may expect to see better varieties of all the "native vegetables" cultivated, and, together with those that have followed the civilization of the white race, in quantities to meet the demand of the home market; in addition there is every reason why some, like the camote, yam, and gabi, should also be grown for export.

There are very few fruits that are indigenous to the Philippines,[1] nearly all being introductions made by the Spaniards from other countries; a considerable number were probably introduced in prehistoric times by Hindu and Malay traders. As may be seen by a glance at the annotated list of Philippine fruits on another page, the number of fruits grown in the Archipelago is considerable, and it is therefore unfortunate that their cultivation is not more general; in fact certain species that are well distributed in some islands are not yet introduced into other parts of the Philippines; for example, such vigorous and easily grown trees as the mango, tamarind, chico, and lanzon.

Literally speaking, fruit *grows* in the Philippines; as yet one can scarcely say that it is *cultivated*, and fruit culture as a science or industry has yet to make its appearance in the Archipelago.

Excepting those planted to seedling mandarins in Batangas, only two regularly planted *fruit orchards* of pre-American origin—one of mango trees in Muntinlupa, Rizal, and another of ciruelas in Pulupandan, Occidental Negros—have been observed by the writer. Asexual propagation of fruit trees by the means of marcottage is practiced by the Filipinos to a limited extent, mainly in propagating the chico; the ciruela is propagated from cuttings, but all other fruit trees are nearly always grown from seed. Budding and grafting are practically unknown and the budded plants (citrus) hitherto set out in the Islands are limited to a few imported by either private experimenters, or this Bureau. The fruits discussed below are those most prominent at present and such as are believed to have a promising future at a not distant date, if handled properly.

The first among these is the cacao. There is scarcely room for doubt but that cocoa, or chocolate, is destined to become the world's greatest beverage. The world's consumption of cacao is increasing at many times a greater rate than that of either coffee or tea, and this in the face of rising prices, while coffee has been falling off somewhat in value. Some little idea of the important rôle cacao might play in the export trade of the Philippines if the cultivation of this plant were undertaken in earnest might be had when it is considered that the little island of Trinidad, during the fiscal year ending 1908, exported over 22,607,160 kilos of cacao valued at ₱17,863,860. In 1910, this had increased to over 30,500,000 kilos, while San Thomé, the

[1] See "Recent Plant Introductions into the Philippines," page 391.

small Portuguese colony on the west coast of Africa, exported more than 36,500,000 kilos. The world's consumption of cacao during the same year was in round figures over 194,000,000 kilos.

The cacao was long ago introduced into the Philippines, and the plant is found in all provinces of the Islands, but its cultivation has never attained prominence as an industry, notwithstanding the fact that certain parts of the Islands are well adapted to its cultivation; as may be seen on another page the importation of cacao forms a very large item in the Philippine imports. The cacao plant is subject to many diseases and insect pests that are inimical to its growth and profitable cultivation; moreover, it requires "culture" of a somewhat higher order than either the abacá or the coconut in order to succeed well, and not until this is realized by both present and prospective cacao-growers will the industry prosper in the Philippines. Judiciously located and cultivated intelligently, cacao plantations should bring much wealth into the Philippines; in fact it may be confidently predicted that if the industry is properly fostered and developed the cacao will in time completely overshadow in value any other single horticultural product of the Philippines.

The cultivation of Arabian coffee (*Coffea arabica* L.) was once a very remunerative industry in certain districts of the Philippines, notably in Batangas; but since the entrance of the coffee blight (*Hemileia vastatrix*), some twenty-five years ago, coffee growing has dwindled into insignificance and coffee is now, as may be noted on another page, *imported* instead of *exported*. After the devastation of the coffee plantations in Java a search was made for a coffee resistant to the blight, and *Coffea liberica* and *Coffea robusta* were as a result of this search brought into prominence, although they are greatly inferior to the Arabian coffee. Both these species have been introduced into the Philippines with a view to reviving the coffee industry and are planted here and there locally in a very limited way. However, the cultivation of these species does not at present affect the importation of coffee from other countries nor judging from the present outlook is it likely to do so in the near future. Many parts of the Philippines are well adapted to the culture of coffee and when the long-sought-for blight-resistant coffee has been found, or rather *originated*, the Philippines may at least produce the coffee consumed at home and perhaps even become an exporter.

The banana, of which there are two if not more species of the genus *Musa*, including at least fifteen and probably more varieties grown in the Philippines for their fruits, is more generally cul-

tivated throughout the Archipelago than any other; cooked, fried or raw it forms a more important part in the diet of the people than any other fruit; none other figures more prominently in the market at all seasons than the banana. It is rather singular that the poorly flavored and least desirable varieties are cultivated in preference to the better kinds though some contend that the reason is that the poorer sorts are hardier. More judicious selection of the varieties grown together with better cultivation would greatly increase both the quality and the quantity of the fruit produced. The local markets are well supplied with bananas but there is ample room for expansion both for the production of fresh fruit for the home market and export, and for the growing of bananas for the manufacture of banana flour, wine, and evaporated fruits.

Citrus fruits.—While the many varieties of bananas are of far greater importance in the diet of the population than any other fruit, the mandarin is—with the exception of the mango—the only one that is exported. The mandarin is grown chiefly in Batangas, especially around the municipalities of Tanauan and Santo Tomás. Excellent mandarins have been obtained by the writer from Tarlac and the Cuyo Islands, while oranges from the latter place, Salasa, Pangasinan, and other points in Luzon, as well as pomelos, limes, and lemons of excellent quality have also been obtained from several provinces; the calamondin, even in its natural state, produces an "ade" fruit of no mean value, and is unexcelled in the form of marmalade. A preliminary study of the citrus fruits in the Archipelago has shown that the Islands possess an unusually great number of forms, some of which promise to become of considerable economic value. Among those are a type of lime known as "Limon Real," of exceptionally good flavor and quality, also a mandarin lime of excellent flavor that has a greater percentage of juice than any citrus fruit that has come to the writer's attention. (See Plate II.) What appears to be a natural hybrid between the tangerine and the orange has also been found. Aside from these, what seems to be three new or imperfectly known species have been found in the Visayas which although inedible may prove to be of value as stocks or for other purposes. Considering the care they receive, the citrus trees throughout the Archipelago are remarkably healthy, and thrifty, and free from injurious scale insects.

During recent years, several varieties of oranges, pomelos, and lemons have been introduced by the Bureau of Agriculture and

private experimenters interested in citrus culture, but it is yet too early to form a correct estimate in regard to the value of these introductions. The success that has attended the introduction of modern methods of cultivation of the citrus fruits in Porto Rico and other parts of the West Indies having a climate essentially like that of the Philippines would seem to indicate that, considering that even now without any culture whatsoever, the Philippines already produce citrus fruits of no mean quality, the Islands could, with better methods of culture, produce very superior citrus fruit. While our production of citrus fruits may not even approach the figures quoted below, it may not be amiss to state that Spain annually exports 40,000 carloads of oranges, Italy 20,000 carloads of lemons, and that the annual production of oranges in Florida exceeds 5,000,000 boxes, the value of which may be estimated at ₱10,000,000.

In Nueva Ecija, Cavite, Cebu, Pangasinan, Bulacan, Bohol and Zambales are located the principal mango-growing districts in the Philippines, but the tree is found to more or less extent in all provinces of the Archipelago. However, not even in the mango-growing centers, is the mango planted as an orchard tree, but rather along the edges of the rice and corn fields, on the roadsides or on hills too steep for the cultivation of field crops.

Soil and climatic conditions are favorable for the growth of the mango everywhere in the Archipelago, but the yield of fruit is small compared to the size and number of the trees. This is undoubtedly due partly to an excess of nitrogen in the soil and lack of culture, and could probably be corrected by applications of potash and phosphoric acid and proper cultivation; it is partly caused by the presence of two species of homoptera, *Idiocerus niveosparsus* Leth. and *Idiocerus clypealis* Leth. which attack the flowers of the mango, two Lepidopterous larvae also destructive to the flower, and a fruit-fly, which attacks the fruit. However, the greatest reason for the sterility of the mango is the fact that the trees are seedlings, and, were they budded, it is believed that the crop might be more than doubled without increasing the acreage, not speaking of other resulting advantages, for instance, such as the production of any desired variety, the control of the fruiting season by budding into late or early varieties, and the dwarfing of the tree to facilitate the gathering of the fruit and the combating of insect enemies and diseases—not of inconsiderable importance in a vigorous and large growing tree like the mango. The Carabao, Pico, and Pahutan are the

three forms most generally grown, and important in the order enumerated; others like the "Señora," "Señora cabayo," and "Pahut" are local and unimportant.

Next to the banana, the papaya is perhaps the most generally grown fruit in the Philippines, but nearly all belong to a dioeceous, degenerate type, producing small, seedy fruits of poor flavor, of which, moreover, a very large percentage are staminate and consequently unproductive. Another bisexual type with large, well-flavored fruits, known in various parts of the Islands as Hawaiian, Dapitan, or Singapore papaya, after the name of the place from which they were introduced, is gradually displacing the other kind. Considering its few cultural requirements, the ease with which it is cultivated, and the rapidity with which it grows, producing ripe fruits in less than twelve months from the sowing of the seed, the impression might obtain that good papaya fruits are abundant, but nothing could be more erroneous, and this notwithstanding the fact that the papaya is one of the fruits in the Philippines that the white resident invariably takes to and for which he is willing to pay a good price and for which there is a good demand that so far has never been supplied.

The pineapple is at present grown chiefly for its fiber, and the fruit is mostly considered as a by-product. Wherever the pineapple has been seen by the writer, and it seems to be introduced in most places in the Islands, it grows well and appears to be exempt from serious insect pests and diseases; still it is grown to a slight extent only. The latest statistics available (1903) place Samar in the lead with an area of 51 hectares in cultivation, Occidental Negros and Tayabas with 41 hectares each, Bulacan 31, and Bataan 30 hectares. Other provinces mentioned with an annual production of more than 20,000 fruits are Leyte, Cebu, Cagayan and Zambales. The pineapples sold in Manila during the pineapple season are grown in Bataan but scarcely in sufficient quantities to supply the demand, while during the greater part of the year there are no pineapples whatever in the market. The varieties grown at present are well flavored, but have a too excessively large crown, with the eyes too deepset, subject to "eyeroot," and the slips too near the base—in fact, frequently attached to the fruit itself—for good market sorts, and being frequently slender, small and tapering, they are likewise unsuitable for canning purposes; not until other varieties have been introduced may we expect to see a pineapple industry come into existence, notwithstanding a climate and soil eminently suited to pineapple culture in many parts of the

Archipelago. Two companies have recently engaged in pineapple growing and it can not be doubted but that with the introduction of better varieties and modern methods of cultivation pineapple culture before many years will become a very important horticultural industry in the Archipelago.

The chico is at present a far more important fruit in the markets than the pineapple, and it may be obtained in every month of the year. The fruit is small, but of remarkably uniformly good flavor and quality. The chico is too sweet for preserving, but it makes an excellent dessert fruit. Few tropical fruits are so indifferent to careless handling as the chico and we may in the near future see it exported in increasing quantities to the nearby Asiatic ports and together with other fruits replenish the supplies of the passenger and freight steamers that call at Manila.

It is in the anticipation of the future rather than on account of the rôle it plays at present in the life of the Filipinos that the seedless breadfruit is here included. The unimproved seedy forms are quite well distributed in the Islands, though they occur very sparingly in certain districts. The seedless variety is seldom found and the fruit is but rarely offered in the market. This is very naturally due to the fact that, being seedless, it is only with difficulty propagated. The breadfruit, as far as has been noted by the writer, appears to be immune to diseases and injurious insects and when an easy and convenient way of propagating the fruit vegetatively has been found, the breadfruit may be expected to rank as one of the leading fruits in the Philippines—not to forget that a large number of varieties are still waiting to be introduced from the Islands of Polynesia.

The avocado, so much esteemed in the American tropics, was introduced into the Philippines by the Spaniards, but for some reason the introduction of this tree did not become permanent, and the few trees that were planted by the Spaniards died—the last one, growing in the plaza west of the Delmonico Hotel, Manila, blew down in a baguio a few years ago—without having produced seed for the propagation of their kind. The avocado was again introduced in 1903 from Hawaii by the then horticulturist of the Bureau, Mr. W. S. Lyon. A number of plants were distributed to fruit growers in the Islands, but the bulk of trees obtained from these importations were planted at the Lamao agricultural experiment station, Lamao, Bataan. Some of the trees have fruited, but the fruit produced is rather inferior as

compared with the best sorts grown in Florida. However, the trees have made a very satisfactory growth, and when superior varieties shall have been introduced, the avocado, on account of its food value, will unquestionably in time rank as one of the most important fruits here.

Of all the plants introduced into the Philippines by the Spaniards no species has been so well disseminated as the guava; in fact, it has long ago become naturalized, due to the dispersal of the seeds by birds which eat the fruit. The products made of the guava, jelly, "cheese" and canned fruit, are unexcelled in flavor and aroma, and a preserving industry for the manufacture of jelly and cheese is gradually growing up in Cuba and South Florida, the canning of the fruit being retarded because of lack of large, fleshy fruits with few seeds, adapted for canning purposes. While of course better varieties with large fruits are desirable for the production of fruit for preserving factories on an extensive scale, the varieties now growing in the Islands yield a fruit from which a first-class jelly and cheese can be made, and any one looking for opportunities in this direction will find the guava the most promising for immediate use of all the fruits grown at present in the Philippines, and of which there can be obtained a comparatively large supply of raw material.

While these are the most prominent of the fruits grown in the Philippines, there are many other more or less important fruits in the local markets all of which are included in the "Annotated List of Philippine Fruits" on another page.

Having reviewed the situation in the past and present and discussed the more prominent fruits and their possibilities, let us now turn to the statistics for the past year and see the actual loss in cash to the Philippines, owing to the neglect of horticulture.

The value of the total imports during the fiscal year ending June 30, 1911, was ₱99,667,444. During this period the following horticultural products were imported:

Cacao	₱523,870
Coffee	510,078
Fruits (fresh, canned and dried)	483,372
Nuts	172,260
Vegetables (fresh and canned, including beans and peas)	1,409,610
Total	3,099,190

This is a greater amount than any other single item imported excepting cotton, ₱20,610,034; rice, ₱13,121,260, and meat and dairy products, ₱5,800,056, and represents about 3 per cent of the total value of all imports into the Philippines; with a population of eight million souls this is a yearly tax of over ₱0.38 on every inhabitant in the Archipelago, including women and children.

The above is relative to our home markets. How badly our nearest export markets have been neglected may be surmised from the fact that during the same period, fruits and nuts to the value of only ₱182 were exported to China, ₱40 to the British East Indies, ₱19,760 to Hongkong, ₱4 to Japan and ₱8 to Australia. The total horticultural exports during the year amounted to ₱48,106. There is no doubt but that Hongkong could readily absorb fruit up to many times the amount that is being sent there, and that much fruit could be exported to China and Japan. Cochin China, like the Philippines, does not supply its own home markets, but imports yearly citrus fruits from foreign countries. Here as in other neighboring countries where the fruit industry is undeveloped, lies the opportunity of the Philippine fruit grower.

Australia is not too far away to receive a considerable share of our horticultural exports and the following statistics from that country, our nearest market from which full statistics are obtainable relative to importation and exportation of the following horticultural products, should prove educating and full of interest.

Imports into Australia, 1910.

Arrowroot	₱36,490
Fruits, dried (other than dates, currants, raisins)	192,690
Bananas	445,490
Citrus fruits	214,890
Pineapples	870
Preserved fruits and vegetables	472,200
Jams and jellies	88,590
Dried or concentrated vegetables	60,250
Cocoa products	3,152,070
Fruit juices and fruit sirups	95,240
Total	4,758,780

Exports from Australia, 1910.

Arrowroot	₱12,150
Dried fruits (other than dates, etc.)	101,700
Bananas	560
Citrus fruits	247,510
Pineapples	39,850
Other fruits	274,770
Fruits and vegetables (preserved)	151,540
Jams and jellies	283,720
Cocoa products	23,730
Fruit juices and sirups	16,200
Total	1,151,730

There is accordingly a trade deficit of over ₱3,600,000 in the products referred to which are supplied by foreign countries, the most important by far of these being cacao.

Some of these products, well adapted to the Philippines, as for instance arrowroot, are shipped to Australia from the far-away West Indies, and Australia receives citrus fruits from the Mediterranean countries and California. How well Australia has fostered her horticultural interests is illustrated in the above statistics and should make the Philippines, with her equal and in many respects superior advantages, blush with shame for her neglected opportunities and stimulate her into organized effort to take her just share of the world's trade in the products that are under discussion. It may not be inopportune to quote here the imports into the Philippines from Australia during the fiscal year ending June, 1911.

Citrus fruits	₱4,000
Other fresh fruits (except apples)	5,800
Dried fruit	5,740
Jam and jellies	9,860
Total	25,400

This is not a large amount in itself; it is in comparison with Philippine horticultural exports to Australia (₱8) that it looms large.

Owing to the long distance to our principal large markets and the perishable nature of most of the fruits cultivated in the Philippines, we can hope to export but few kinds of fresh fruits. However, with proper handling we should have but little trouble in placing oranges, mandarins and pomelos in the principal markets of Australia and perhaps bananas and mangos. Owing to our geographical situation with consequent

ripening of the fruit at a different season than the same fruits in Australia, these fruits would not compete with the home-grown fruit in that country, and it seems reasonable to believe that with our superior soil and cheaper labor as well as being much nearer to the Australian ports, we may expect to successfully compete with Spain, Italy and California for the citrus fruit trade of Australia.

The production of fresh fruit for export should be a considerable item; however, the manufactured products—fruit, canned and dried, crushed and grated, made into jams, jellies, and marmalade, fruit sirups, flavoring extracts, and wine—is the one item that is destined to be of primary importance. In this form the Philippine fruits may find their way not only to our nearby markets, but to those in the Americas and Europe. At present most of the fruit preserves used in the Tropics come from the Temperate Zone but there is no good reason why the Tropics should not at least send an equivalent of preserved tropical fruits in exchange for those received from the Temperate Zones. Hawaii has within the last few years shown what may be accomplished in this line in growing and canning pineapples, and with an even better soil and an equally good climate, the Philippines may well not only imitate her sister Archipelago, but may well make pineapple growing and canning the nucleus of a preserving industry that will expand until it includes all the tropical fruits grown in the Archipelago that may thus be utilized.

Fruits and vegetables are the two great horticultural products, but there is a third, spices, the production of which in some countries yields great profits to the planters. Some of the spices, such as black pepper, ginger, and cinnamon, have been introduced, but their cultivation has never become of any importance; yet the first-named grows practically wild in certain places. Ginger alone is grown to any extent but yet not enough for home consumption. Part of the Philippines possess ideal climatic conditions for the cultivation of vanilla, yet no one has attempted its culture here; this is also true of the nutmeg and cardamon. With the introduction of good varieties, with dangerous fungi and insect pests excluded, with a better knowledge of modern methods of culture on the part of the people, and with coöperation on the part of the Government, there is reason to believe that the growing of spices may yet take high rank among the horticultural crops of the Philippines.

ANNOTATED LIST OF PHILIPPINE FRUITS.

By

P. J. WESTER, *Horticulturist,*

AND

O. W. BARRETT,

Chief, Division of Experiment Stations.

1. Alubihod, *Spondias mangifera* Wall., a tree related to the mango, bearing yellow fruits of the size of a small plum, indigenous to the Philippines; rarely cultivated.

2. Alupag, *Euphoria cinerea* Radlk. Indigenous to the Philippines and widely distributed. The fruit is similar to the litchi, but smaller.

3. Banana, *Musa* spp. The banana is the most universally cultivated fruit in the Philippines and occurs in a greater number of varieties than any other fruit in the Islands. The following varieties are more or less common and important in the order of their enumeration: Lacatan, Latundan, Sabá, Gloria, Bungulan, Butúan, Matabia, Lacatan Morado, Daliring Señora, Ni-lanzon, Tundoc, Chinese Dwarf. Specimens of a very interesting form called Dominus vobiscum has also been noted by the writers, but it is doubtful whether this is a constant variety or merely an anomalous form of Sabá.

4. Biasong, *Citrus* sp. A small, oblong, pyriform, very distinct fruit from others of the same genus, found in Cebu.

5. Bignay, *Antidesma bunius* Spreng. A small ornamental tree, occurring in all parts of the Philippines; the small darkred sub-acid fruits are produced on long racemes like the red currant.

6. Bitungol, *Flacourtia sepiaria* Roxb. A small shrub, seldom cultivated, having small, purplish, sweet fruits.

7. Bobog, *Sterculia foetida* L. A medium-sized deciduous tree, indigenous to the Philippines, and seldom cultivated; the large seeds have a pleasant nutty flavor and are eaten.

8. Breadfruit, *Artocarpus communis* L., of which there are three forms, one perhaps a separate species. The seedy types occur in most municipalities but the seedless variety is very rarely grown, and is found chiefly around Manila and in Pangasinan.

9. Cabuyao, *Citrus hystrix* D C. This tree is found in most municipalities, although usually in few numbers in each municipality; there are several varieties.

10. Cacao, *Theobroma cacao* L. The Forastero type is well disseminated throughout the Archipelago but cacao culture has nowhere assumed much importance.

11. Calamondin, *Citrus mitis* Blanco, is quite generally distributed and the fruit may be found in the municipal markets throughout the year.

12. Camanchile, *Pithecolobium dulce* Benth. Of general distribution in the more accessible provinces of Luzon and to some extent in the other parts of the Archipelago.

13. Camia, *Averrhoa bilimbi* L. Well distributed in most parts of the Philippines and more commonly cultivated than the nearly-related carambola.

14. Carambola, *Averrhoa carambola* L., of which there are two varieties, is of limited and local cultivation.

15. Cashew, *Anacardium occidentale* L. Fairly well disseminated, but grown to a limited extent only.

16. Catmon, *Dillenia philippinensis* Rolfe. A tree indigenous to the Philippines having large green acid fruits.

17. Cereza, *Muntingia calabura* L. Well introduced in the more accessible provinces of Luzon.

18. Chico, *Achras sapota* L. The chico is fairly generally distributed and one of the principal fruits in the Manila market.

19. Chico-mamey, *Lucuma mammosa* Gaertn. The culture of this fruit is confined chiefly to Laguna and Cavite.

20. Ciruela, *Spondias purpurea* L. One of the most popular fruits in the Philippines, notwithstanding its large seed in proportion to the flesh.

21. Citron, *Citrus medica* L. Rarely found except in the gardens of hacenderos.

22. Coconut, *Cocos nucifera* L. About ten varieties are found here, all but two being more or less localized. Though the most important fruit, or nut, commercially, it does not enter into the diet of the Philippine people to a very great extent; they consume considerable quantities of the oil, and a little of the "meat" but seldom drink the "milk."

PLATE II.—THE PHILIPPINE MANDARIN LIME (*Citrus nobilis* Lour.).

FIG. 1.—Tundoc (*Musa paradisiaca* L.).

FIG. 2.—"Ni-lanzon" (*Musa* sp.).

PLATE III.—TYPES OF BANANAS.

23. Coffee, *Coffea arabica* L., has been introduced almost everywhere, but since the appearance of the coffee blight, *Hemileia vastatrix*, its cultivation has become of little importance. *Coffea liberica* and *Coffea robusta* have been introduced, but are grown only locally.

24. Colo, *Citrus* sp. A rather large, pyriform fruit occurring in Cebu.

25. Custardapple, *Anona reticulata* L. Found quite generally in Central Luzon as far north as Pangasinan and south in Rizal, Cavite and Batangas, more sparsely in Visayas; less esteemed than either the sugarapple or the soursop.

26. Date, *Phoenix dactylifera* L. Noted at Iloilo only; so far as known the date has never fruited in the Philippines.

27. Duhat, *Eugenia jambolana* Lam. Very generally disseminated and considerable quantities of the fruit are marketed during its season of maturity.

28. Durian, *Durio zibethinus* Lam. Confined to the Sulu Archipelago and Mindanao.

29. Fig, *Ficus carica* L. Of rare occurrence; does not succeed well.

30. Granadilla, *Passiflora quadrangularis* L. A climber related to the papaya; of limited and local cultivation.

31. Grape, *Vitis vinifera* L. The grape was introduced by the Spaniards and is cultivated principally in Cebu; vines are also found to a very limited extent in Manila, also in Bataan and other provinces.

32. Guava, *Psidium guajava* L. One of the most generally grown fruits in the Philippines, although at present neglected and of little commercial importance.

33. Iba, *Phyllanthus distichus* Muell., occurs sparingly in the more settled provinces of Luzon.

34. Igot, *Eugenia* sp. A small tree, bearing a red cherry-like sub-acid fruit of good flavor, sparsely cultivated in the Visayas; unknown in Luzon.

35. Jak, *Artocarpus integrifolia* L. One of the most widely disseminated and cultivated fruits in the Archipelago.

36. Kaki, *Diospyros kaki* L. Of local and very limited cultivation.

37. Lanzon, *Lansium domesticum* Jack. Not a fruit of general distribution; outside of Mindanao it is grown chiefly in Cebú and Laguna.

38. Lemon, *Citrus limonum* Risso. The lemon is grown to

less extent even than the lime; in fact, it scarcely ever appears in the market; three very distinct varieties occur.

39. Lime, *Citrus limetta* Risso. The lime occurs in several varieties; the best of these is the "limon real," a rather large oblatly flattened fruit, the better seedling trees of which produce a very superior fruit. The species is of general distribution throughout the Philippines but is less in evidence than the pomelo, mandarin, orange, and calamondin.

40. Limoncito, *Triphasia aurantiola* Lour. Sparsely disseminated in Luzon and the Visayas.

41. Longan, *Euphoria longana* Lam. Introduced many years ago, but only a few trees are extant; these have not, as far as known, ever fruited.

42. Mabolo, *Diospyros discolor* Willd. Of general distribution throughout the Archipelago.

43. Macopa, *Eugenia javanica* L. Well distributed, particularly in the Visayas; the fruit is very ornamental, but dry and tasteless.

44. Macopa, *Eugenia malaccensis* L. A far better fruit than that of *E. javanica*. The tree, however, is not well distributed. Closely related to the preceding species.

45. Mandarin, *Citrus nobilis* Lour. The most generally cultivated species in the genus. It is fairly well disseminated throughout the Islands but Batangas is the only province where its cultivation has assumed any importance. Commercially the mandarin is the second most important fruit in the Philippines. A very interesting form of this species exists, the flesh of which is white, exceedingly juicy, pleasantly acid, and without a trace of sugar.

46. Mango, *Mangifera indica* L. The third most important fruit in the Philippines. The Carabao, Pico, and Pahutan (Paho in the Visayas) are the types important in the order named, and the ones in general cultivation. Local varieties of little importance are the Señora, Pahut, Señora cabayo, Cabuyo, Bulac, and Paho (distinct from that fruit in the Visayas). The Provinces of Cavite, Cebu, Bohol, Nueva Ecija, Pangasinan and Zambales lead in the production of mangos. In certain parts of the Visayas the mango is still scarce, or only poor varieties are cultivated.

47. Mangosteen, *Garcinia mangostana* L. Confined to Mindanao and the Sulu Islands.

48. Manzanita, *Zizyphus jujuba* L. Confined almost entirely to Luzon where it is of local and limited cultivation.

49. Mulberry, *Morus nigra* L. Introduced many years ago but of limited distribution only.

50. Orange, *Citrus aurantium* L. Fairly well distributed but of limited cultivation; grown principally in Batangas, Cuyo Islands and Pangasinan.

51. Pangi, *Pangium edule* Reinw. A tree producing a well-flavored, edible fruit. Confined to the Visayas. Not in cultivation.

52. Papaya, *Carica papaya* L. Next to the banana the most generally cultivated fruit in the Philippines. Three distinct types occur.

53. Pili. A name applied to two species, *Canarium ovatum* Engl. and *C. pacyphyllum* Perk., both native of the Visayas, the latter-named species occurring as far north as Tayabas in Luzon. Both species produce a nut of exceedingly good quality. Generally cultivated in coconut plantations. The husk is sometimes eaten.

54. Pineapple, *Ananas sativus* Schott. Of general distribution throughout the Islands but grown for its fiber rather than for its fruit.

55. Pomegranate, *Punica granatum,* L. The cultivation of this plant is local and limited.

56. Pomelo, *Citrus decumana* L. Found more evenly distributed in the Archipelago than any other species of the genus, it is, however, never grown extensively. Seedlings producing excellent fruit, some nearly seedless, have been found in several provinces.

57. Roselle, *Hibiscus sabdariffa* L. An annual, malvaceous herb, attaining a height of 1.5 to 2 meters, the leaves of which may be used as "greens," and together with the tender stems utilized in the manufacture of jelly, flavoring sirup, and wine. The full-grown fleshy calyces are also used in making a sauce as well as jelly, sirup, and wine. The most important recent introduction.

58. Samuyao, *Citrus* sp. A small, nearly round fruit, conspicuously dented at the apex, growing in Cebu. (See Philippine Agricultural Review, Vol. IV, No. 10, Plate III (a).)

59. Santol, *Sandoricum indicum* L. Widely distributed throughout the Philippines, but not extensively cultivated.

60. Soursop, *Anona muricata* L. Perhaps the most widely grown of all the Anonas in the Philippines.

61. Strawberry, *Fragaria vesca* L. The cultivation of the strawberry is chiefly confined to Benguet.

62. Sua, *Citrus* sp. An oblately-flattened citrus fruit grown in Cebu and other parts of the Visayas; possibly a variety of *Citrus medica* L. (See Plate II, Vol. IV, No. 10, Philippine Agricultural Review.)

63. Sugarapple, *Anona squamosa* L. A general favorite nearly everywhere north of the Visayas, but rare in the south except in Iloilo.

64. Tamarind, *Tamarindus indica* L. Well disseminated nearly everywhere in the Islands.

65. Yambo, *Eugenia jambos* L. The least common of all the Eugenias included in the list, though second in value only to the Duhat.

66. Zapote, *Diospyros ebenaster* Retz. Confined chiefly to the Island of Luzon; of local and limited cultivation.

ANNOTATED LIST OF PHILIPPINE VEGETABLES.

By

P. J. Wester, *Horticulturist,*

AND

O. W. Barrett,

Chief, Division of Experiment Stations.

1. Apalia, *Momordica balsamina* L. A cucurbitaceous vine of very general cultivation throughout the Archipelago, the fruit and tender foliage of which are eaten by the natives. On account of a bitter principle the plant contains it is unlikely to come into use by Caucasians.

2. Banana, *Musa* sp. The flowerbuds of the banana are extensively used as a vegetable in all parts of the Philippines.

3. Batao, *Dolichos lablab* L., of which there are several varieties, is a trailing or climbing legume of very general cultivation. The tender young pods are eaten.

4. Beet, *Beta vulgaris* Mog. Only slightly known, becoming generally cultivated.

5. Buting, *Phaseolus vulgaris* D C. Grown to a considerable extent, particularly in Luzon.

6. Cabbage, *Brassica oleracea* L. In fairly general cultivation; does particularly well in the mountain districts.

7. Cadyos, *Cajanus indicus* L. Several varieties of this plant are distributed fairly well in all provinces; the seeds are eaten like beans or peas.

8. Camote, *Ipomoea batatas* L. This is the most important of the root-crops in the Archipelago; the number of varieties found here at the beginning of the American occupation has been greatly added to by the introduction of many varieties from the United States and other countries.

9. Carrot, *Daucus carota* L. Grown to a limited extent only, but becoming generally cultivated.

10. Cassava. *Manihot utilissima* Pohl. The cassava plant is

found everywhere and is of considerable importance as a root-crop.

11. Celery, *Apium graveolens* L. Recently introduced from the United States. It is one of the few vegetables with which very little success has been made.

12. Chile, *Capsicum minimum* Roxb. Commonly found nearly everywhere in the Archipelago. *Capsicum annuum* L., also known under the same name, is cultivated to a limited extent only.

13. Coletis, *Amaranthus oleraceus* L. Commonly cultivated around Manila, rare in the provinces.

14. Condol, *Benincasa cerifera* Savi. A cucurbitaceous vine having a melon-like fruit. It is well distributed throughout the Philippines.

15. Cucumber, *Cucumis sativus* L., called pepino in the Philippines, is somewhat less extensively grown than the water melon; the quality of the native varieties is very good.

16. Eggplant, *Solanum melongena* L. Well distributed and one of the most important vegetables in the Philippines. The variety generally grown has long slender snake-like fruits of good quality.

17. Endive, *Cichorium endivia* L. Of recent introduction; the cultivation of this plant is rather restricted.

18. Gabi, *Colocasia antiquorum* Schott., of which there are several varieties, is extensively cultivated for its edible roots. Few of the white population in the Archipelago are aware that the better varieties of this plant make an excellent substitute for the potato. It grows best on moist rich lands and is easily cultivated. One of the most promising of the "native vegetables."

19. Garlic, *Allium sativum* L. Grown chiefly in Batangas and to some extent in the Visayas.

20. Lettuce, *Lactuca sativa* L., is in fairly general cultivation.

21. Libato, *Basella rubra* L. A trailing vine, the leaves of which are tender, succulent and make excellent "spinach." It is fairly well distributed throughout the Archipelago. The libato is an annual grown from seed and succeeds best in rich, moist but well drained land, and deserves far more attention than so far has been accorded this plant by both Filipinos and Caucasians.

22. Magtambocao, *Canavalia ensiformis* D C. Sparsely cultivated for its edible beans.

23. Malungai, *Moringa oleifera* Lam. A small tree very generally grown; the pods and leaves are utilized as a vegetable.

24. Melon, *Cucumis melo* L. Several varieties are cultivated

FIG. 1.—Seguidilla (*Psophocarpus tetragonolobus* D C.).

FIG. 2.—"Native" Eggplant.

PLATE IV.—TYPES OF VEGETABLES.

extensively; the quality of nearly all is, however, far inferior to melons grown in the Temperate Zone.

25. Mungo, *Phaseolus mungo* L., of which there are several varieties, is quite generally grown everywhere for its beans.

26. Mustard, *Brassica juncea* Coss. Cultivated to a limited extent only; becoming better known.

27. Okra, *Hibiscus esculentus* L., is in very general cultivation.

28. Onion, *Allium cepa* L. Cultivated principally in the Mountain Province; to a limited extent, locally, in other provinces.

29. Pacupis, *Trichosanthes anguina* L. A cucurbitaceous, climbing vine, cultivated for its long snake-like fruits. It is fairly well distributed throughout both Luzon and the Visayan Islands.

30. Panarien, *Tacca pinnatifida* Forst. A succulent plant, the tubers of which are used in the manufacture of starch. The Panarien is probably indigenous to the Philippines, but seldom cultivated.

31. Parsley, *Carum petroselinum* Benth. and Hook. Of local and limited cultivation.

32. Patani, *Phaseolus lunatus* L. Is very generally cultivated; there are several varieties, nearly all climbing.

33. Patola, *Luffa acutangula* Roxb., and *Luffa aegyptiaca* Miller, two climbing cucurbits, are cultivated everywhere for their edible fruits, which when ripe, furnish the "vegetable sponge."

34. Pea, *Pisum sativum* L. Cultivated locally only; grows best in the mountain districts.

35. Pechay, *Brassica pet-tsai* Bailey, is fairly generally cultivated.

36. Potato, *Solanum tuberosum* L. Cultivated locally only and succeeds well only in the higher altitudes.

37. Pumpkin, *Cucurbita pepo* D C., of which there are four or more kinds, is common in most communities.

38. Radish, *Raphanus sativus* L., of which a Chinese large-rooted, white variety is the one most commonly cultivated, is quite generally grown everywhere.

39. Seguidilla, *Psophocarpus tetragonolobus* D C., a leguminous climber with delicious, tender, edible pods, is of fairly general cultivation. The extended cultivation and use of this excellent legume cannot be too strongly recommended.

40. Síncamas, *Pachyrhizus angulatus* Rich., a leguminous climbing vine extensively cultivated for its fleshy sweetish roots.

41. Sitao, *Vigna catjang* Endl. In general cultivation; several varieties are grown.

42. Squash, *Cucurbita maxima* Duch., of which there are ten or more varieties, is very generally cultivated throughout the Archipelago.

43. Tomato, *Lycopersicum esculentum* Miller. The tomato is among the most commonly cultivated vegetables in the Philippines and succeeds extremely well; those in cultivation are mostly of a poor and degenerate type.

44. Turnip, *Brassica rapa* L. Quite commonly cultivated.

45. Ube, *Dioscorea alata* L., of which there are several varieties. Yams are perhaps next to the camote the most prominent root-crop in the Philippines, of which the Ube is the most important among the eight or more "native" species of Dioscorea. As yet hardly ever eaten by any but the native population, the better varieties of this delicious and nourishing vegetable can not be too strongly recommended to the white settler.

46. Upo, *Lagenaria vulgaris* Seringe., of which there are two well defined types, is a cucurbit of very general occurrence in all parts of the Islands.

47. Water melon, *Citrullus vulgaris* L. Very generally grown everywhere, but the melons are of inferior quality.

THE WORLD'S WIDEST-KNOWN FRUIT.

By O. W. Barrett,
Chief, Division of Experiment Stations.

The orange, the apple, and even the old date have their range limits and spheres of influence, so to speak, on account of the exigencies of transportation and the tastes of the peoples; there is one fruit, however, that with the exception of the natives of Siberia, Thibet, and Greenland, is known in the flesh in practically every country of the world to-day. Twenty-five years ago this statement would not have been true, but a quarter of a century hence, it will probably be even more strikingly evident than it is to-day. Being the most widely known does not mean the *best* known; strictly speaking, the apple is probably the best known scientifically, and the coconut is probably the most important fruit to-day.

The banana, however, though known to comparatively few people in its intimate life history, has traveled farther and helped to feed more human beings than any other fruit. The plant itself being pretty nearly confined to the Tropics is known to perhaps only one-half of the people who know the *fruit;* the latter, at least in some varieties, fortunately endures considerable mishandling and comercial illtreatment, so that the fruits may be sold in Sweden or Canada for a price but little higher than that demanded in countries bordering on the Torrid Zone.

Furthermore, when we come to the point of defining just what a banana is, several difficulties confront us: For instance, is a plantain a banana, and where shall we draw the line in classifying the species in the family as to whether the fruits or the plants themselves should bear native local names or the general term? In the first place, the origins of the words banana and plantain are obscure. The early explorers of Africa claimed that the Guinea Coast natives, as far back as the sixteenth century, called the fruits of the several varieties "banana;" the plant probably came some few centuries previously

from tropical Asia. The first appearance of "plantain" was as the Spanish word "plántano," or "plátano," which signifies the plane-tree—which has nothing to do with the case. No philologist would attempt to prove that plátano, or plantain, was etymologically connected with "pisang," the Malaya word —much less with "saguing," the Tagalog equivalent.

In the Polynesian and African dialects there is usually a deplorable tendency to apply the name of a certain type of bananas to the several varieties thereof, even when considerable differences are in evidence; in other words, while there may be a general word for the plant in a certain island or district there are perhaps four or five popular names for the several types of the fruit, each of which may have several more or less undistinguished varieties. Porto Rico of all countries is said to be the most "particular" and accurate as to the local names of its plants; yet the writer, after three years' study of the banana varietal names there, was still uncertain on some points of the synonymy. This difficulty of distinguishing the varieties, on account of the great similarity of the plants of a given type and of the local variation of the varieties themselves, caused by difference of soil, season, cultivation, etc., has deterred many planters and writers from going to the bottom of the question.

Partly on this account, there is to-day no collection of bananas anywhere that at all approaches completion.

Botanists have always shunned them because it is almost impossible to prepare good herbarium specimens thereof; horticulturists find them difficult propositions because of their uncertain or delayed productiveness and individual, seldom well understood, traits of character; the planter is usually content to raise one or two sorts only—those which will endure the most mistreatment in shipping. Without artificial heat the collector can scarcely hope to dry a specimen of the flower (sic) before it decays, and he stops aghast before the 6-meter leaf of Ensete, or the Abyssinian banana. Having no fixed period of flowering, and a root-system sensitive to every influence, these plants satisfy their own whims rather than follow any line of action or fruiting schedule laid down by any horticulturist.

Only one of the 250 or more kinds of bananas and plantains now known has ever been largely "in the trade;" in its home plantations, however, this variety, known as *Jamaica, Costa Rica, Gros Michel, Guinea,* etc., is considered fit for the oxen while other sorts are used on the tables of the planter and his laborers. In short, although the banana is one of the world's oldest cul-

tivated fruits, and the most widely and largely known as a general-purpose fruit, it is one of the least understood, yet one of the most interesting of all economics that concern the welfare of man.

Before the dawn of agriculture as a science, the banana had begun to play a prominent part in human history. From the numerous wild species occurring throughout Africa and southern Asia it is logical to conclude that some and probably all of the domesticated sorts were taken from these continents. Dr. O. F. Cook, an American authority on plant history, suggests that, in company with the closely related Heliconias from tropical America, the banana was originally grown as a root-crop; it seems that one or more of the Heliconias had been included with a number of other good food-plants when the migration began Asia-ward from the old Caribbean region; but as soon as the root-culture method was applied to the similar-appearing wild bananas—*i. e.*, after a few centuries—it was noted that the fruits, gradually growing less seedy and more edible, were of more account to the native husbandman than the acrid, fibrous bulb at the base of the "stem."

The fact that one of the old searovers, who happened to be prowling about that part of the coast of South America now called Venezuela soon after Columbus had broken out the route, noted in his log-book that he had sent his "small boats up a river to lay in a stock of these fruits" (probably the semi-cultivated cooking "plantain," similar to the Sabá of the Philippines), is of great interest.

Most of the really wild bananas are to-day found only in the back districts of Africa and south-eastern Asia; Central America and the larger islands of the Pacific, however, contain many semi-cultivated forms. It is said that perhaps the largest plantains in the world are grown in the great alluvial basin of the Kongo. Many sorts new to horticulture may be discovered among the savage tribes in the hinterlands of the Dark Continent as soon as those regions are "opened up."

Several varieties have probably been lost in the last two decades in the interiors of the larger islands of the Hawaiian Archipelago; there the natives used to count largely on their many strange and rare kinds of bananas and plantains as a cheap food supply, but since the great sugar estates have drawn the people of the uncultivated interior down to the lowlands, the half-wild cattle, goats, and pigs roaming through their unfenced and abandoned plantations have devoured "root and

branch" the whole stock of some, if not many, of those old and once very important fruits.

In central Africa there are numerous tribes that rely to a very great extent upon the plantain as one of their main rations; in fact, some writers have classified the people of Africa into *date-eaters*, in northern Sudan; *banana-eaters*, in the central regions; *meat-eaters*, in the eastern districts; and *grain-eaters* (kafir-corn, maize, and millets), in the western and southern portions.

Likewise in the Polynesian Archipelagos, the banana vies with the coconut as the most important food-plant; but, as in the case of Hawaii, many of the local varieties are doomed to become extinct within a few decades on account of the change of habits of the people. It is most unfortunate that some government or keenly interested plant lover has not taken up the matter and ransacked the whole Pacific for banana varieties. The exact number of kinds, native and more or less confined to the Archipelagos, can only be vaguely estimated, there probably never having been any attempt to get them all together. Two or three very distinct species are found there only; for instance, the peculiar *Fehi*, bearing the bunch of fruit erect above the stem instead of pendent below the crown of leaves, and having a violet, or blood-like sap; one variety of this type has been successfully introduced into the British West Indies, and a strange, possibly related sort, without the red juice, was found at Los Baños, Laguna, some time ago.

Recently authorities on the botany of this interesting subject have been forced to admit, from the great amount of material which has been brought to their attention, that the differences between bananas and plantains are insufficient to warrant the two plants being considered as really separate species any longer. Formerly all the true bananas were considered as belonging to *Musa sapientum*, while plantains were grouped under *M. paradisiaca* (the latter was fancifully supposed (?) to have been the original "forbidden fruit" in the Garden of Eden legend). There are connecting links and all kinds of gradations separating, or rather joining these two classes of fruits. Some of the so-called plantains, like the *Sabá*, for instance, of the Philippines, are apparently bananas as far as the flowers and fruit-stems go, yet by another classification they belong to the "cooking kind" in which probably all of the so-called plantains should be placed. In fact, after all is said and done, the practical difference between a plantain and a ba-

nana fruit is based upon the fact that the former is eaten only cooked, and the latter both raw and cooked.

However, it must be admitted that among some plantains, notably those of the so-called "Kongo" type, which the writer discovered in Porto Rico in 1902, the fruit-stem is peculiar in having the "bud" of unopened flowers at the tip of the stem entirely dried up instead of being fresh and full of unopened purplish bracts as in the case of the true bananas; many of the plantains of the "*Kongo*" type, moreover, have but two or three hands, *i. e.*, perhaps ten to twenty fruits in the average bunch; this dried-flower-bud feature is practically never to be noted among the bananas.

By the way, it is interesting to note that in some varieties of bananas the number of "hands" may be double or treble the number seen in commercial bunches; *i. e.*, it is possible to find bunches of bananas with twenty, thirty or even more "hands," each "hand" containing perhaps ten or fifteen fruits; in fact, there are numerous cases on record in which the end of the fruit bunch was below the base of the stem—so that a small pit had to be excavated to prevent the fruits resting upon the ground; this feature occurs probably only with the *Chinese*, or *Dwarf-stem* type and its close relatives, some of which are known as the *Elephant's Trunk* banana.

Banana teratology is full of strange facts. A variety in Porto Rico has the bunch double—one being attached below the tip of the other. In the West Indies a double-stemmed banana is not very rare, while the writer knew of one case in which each part of a double stem *divided again*, thus forming four stems from the one base—each of which might, under favorable circumstances, produce a bunch of fruit. One of the commonest malformations among bananas is the adhesion of the fruits of a "hand;" in pronounced cases of this phenomenon, one unbroken skin covers each layer of the "hand" and sometimes all the fruits of both the upper and lower tiers. Obviously such web-fingered sorts are grown only as curiosities.

While it is manifestly impossible to classify bananas into a definite number of types, the following list will give an idea of the principal groups under which most of the food bananas (including plantains) may be placed:

1. The genuine plantains, represented in the Philippines by the *Tundoc*.

2. The false plantains represented here by the *Sabá*, *Matabia*, etc., and by the semi-wild bananas of tropical America.

3. The red plantains which grade gradually into smaller varieties of "purple bananas."

4. The *Kongos* of the West Indies and probably also of West Africa including both the purple and yellow-skinned forms.

5. The commercial market type, or *Jamaica*, which has comparatively few sub-varieties.

6. The *Chinese*, or *Dwarf*, type.

7. The *Apple*, so called from the fancied odor and taste of some forms.

8. The Lady-fingers, including at least three sub-types with rather thin skins and more or less sweetish, yellowish pulp.

9. The Egg, or *Hua Moa*, peculiar to the Hawaiian Archipelago, although an apparently related type, the *Ni-lanzon*, of the Philippines, might be included here.

10. The fragrant bananas of the Malayan region (which would be extremely valuable were it not for their fault of dropping from the stem before ripening.)

11. The *Fehis* of the southern Pacific.

12. The more or less seedy, semi-cultivated types of which there are many varieties in Africa, Asia, and the West Indies.

Judging from the writings of Raoul, Watt, and others, it is probable that the present number of distinct banana and plantain varieties is in the neighborhood of 250; probably about one-half of this number would be popularly classed as bananas, while about one-fourth would be plantains, or cooking bananas. It is questionable whether any collection has been made of more than fifty varieties, not including synonymous names, of course. The Chinese banana may be known to more individuals than the old Jamaican, or Costa Rican, which is now more or less familiar to practically every European and nearly every inhabitant of the New World from Alaska to Patagonia. Throughout Africa and tropical America some form of plantain is more often used as food (cooked) than probably any other variety of the family in those regions.

Unfortunately the raw banana is not an ideal food; some kinds, if eaten in quantity, cause indigestion. "Banana baby" is the colloquial name of a comparatively new disease among young children among the poorer classes in large cities. The content of starch and pectin is in such a form that the human stomach can not readily digest it, although, of course, the small amount of sugar is easily absorbed. Cooking, however, quickly changes this more or less indigestible starch or gum into an excellent food. Even unripe plantains and bananas

become digestible when boiled or baked, or even when fried over a slow fire. In fact, it might be roughly estimated that the ordinary ripe banana is rendered five times more valuable as human food *by cooking*. The modern threpsologist has a great amount of work ahead of him in the study of the comparative nutritiousness of the bananas and plantains.

An interesting point to be borne in mind in the study of bananas as food is the ease with which almost any variety can be made into meal or flour; and this plantain meal, or meal made from unripe bananas, is unquestionably one of the richest foods to be found anywhere.

Our neighbors in Saigon are making banana wine and champagne, while a delicious cordial is made in the West Indies; British Guiana is turning out banana coffee; Jamaica exhibits banana sugar; and several countries have done more or less with banana vinegar and dried bananas. By the way, "banana oil," used in metal paints, has no connection with the banana aside from its odor. A few years more and we shall see—let us hope in the Philippines *first*, in time for the increased Panama-canal traffic—all of these products on sale in wholesale lots, and at fancy prices.

In the Tropics of both hemispheres a "concentrated ration" is commonly used as food for invalids, children, and dyspeptics. The method of preparation is comparatively simple: The nearly ripe fruits are sliced or dried either in the sun or in an artificial drier, then ground and stored away from dampness. Upon being mixed with boiling water or preferably baked or boiled as a pudding, "mush" or gruel, a highly flavored and exceedingly wholesome dish is had. In the case of plantain flour the peculiar tart or "sweet-acid" flavor is preserved remarkably well; either alone or mixed with wheat flour or maize meal it makes a fine cake, biscuit, or pastry dainties. For several years various concerns and individuals have been experimenting with the handling of banana flour products and in some cases success has been pronounced; but it must be remembered that the public is almost always very slow to accept a new food, be it fruit, flour, or root. And, therefore, while the general attitude of the American and European housewife is favorable to banana productions, it will require another decade before we shall see the due quantity of such foods in every day use in the North Temperate Zone. The poorer classes will not be able to use banana coffee, banana "chips" (a breakfast food), and the various banana flours, "figs" (dried slices

of ripe fruits), etc., for the reason that these products can never hope to compete in prices, bulk for bulk, with wheat or maize—at least not until banana culture shall enter upon a more favorable era than it now enjoys, especially in such countries as the Philippines.

Humbolt stated that the banana could produce more food per acre per year than any other known economic; while this statement may be justly questioned, there is no doubt that the banana is one of the three best food plants the world has ever known. A hectare planted to bananas is estimated to yield some "133 times as much food as the same area of wheat or some 44 times as much as that area of potatoes."

The consumption of the Costa Rica, or Jamaica variety of bananas is steadily increasing. Costa Rica alone now produces over ₱9,000,000 worth of this variety—which is about one-half of the total export trade of that country. Jamaica produces something like 15,000,000 bunches per year valued at about ₱8,000,000, a large part of these going to the United States while the remainder go to Europe. Brazil ships over 500,000 bunches to Argentina; Paraguay is following Brazil's example, and finds a ready market in the great and rapidly growing emporium of Buenos Aires. Honduras also sends nearly ₱4,000,000 worth of bananas to the United States yearly, while the State of Panama is now sending thither nearly ₱3,000,000 worth.

About 130 "banana boats" are now plying between tropical America and the United States; these steamers are fitted up to take a cargo of about 20,000 bunches. There are several new 5,000-ton steamers on the Jamaica-England run that can carry up to 60,000 bunches; these are fitted with the latest cool-air system which maintains an even temperature of about 13° (56° F.); on account of the danger from either heat or cold during the exposure of handling, the entire 500-car-load cargo must be discharged *in one day;* hence the 300 or more men, as well as the huge lifting cages and the endless-belt conveyors have to hustle.

Unfortunately a very severe disease has appeared within the last few years in the larger plantations of Costa Rica, Honduras, and Jamaica; the plants attacked soon begin to wilt and the entire hill, or stool, gradually dies down; the soil in the immediate vicinity of the attacked plants remains infected for a considerable time. A somewhat similar disease has made its appearance in the Philippines, but thus far has been kept in check. The banana has very few insect enemies, though in the

Philippines a butterfly leaf-roller is in evidence; there is also a root-weevil here, the grub of which bores through the base of the stem, weakening, if not actually killing, the plant.

Reckoning the cost of a bunch of bananas at from ₱0.20 to ₱0.30, on large plantations, and the wholesale market value thereof at ₱0.60, there is clearly a profit of at least ₱0.30 per bunch. With 700 first-class bunches per hectare per annum, the profit should be well over ₱200 per hectare. Local conditions, of course, greatly modify any figure which might be given relative to possible yields and returns in the Philippines.

An expert musologist is, of course, required to get the maximum of good results in a banana plantation. Few people realize that there are at least three distinct types of suckers produced by the mother plant and much depends upon the proper selection and treatment of these reproductive materials. Space does not permit a discussion of this interesting subject here, but in passing, we should note that theoretically, all bananas and plantains can be made to *produce seed*—though, of course, such a method of propagation is of interest only to the horticulturist.

The following directions for causing a banana to produce seeds were given the writer by a Porto Rican native, who was unquestionably a banana-culture expert: Get a stool of bananas growing rapidly in shallow soil by the addition of artificial fertilizers; let one bunch of fruits "set," but before that ripens cut down all but one of the stems in the clump; the remaining shoot, "thinking it has but one more chance to perpetuate its kind before being killed," on account of the tremendous shock to the more or less connected stem bases in the clump, at once produces a small bunch of somewhat abnormal fruits some of which will contain genuine seeds. As a matter of fact, it is a usual thing to find seeds in the commonest of the Philippine bananas, the *Sabá*. This phenomenon has really a great value in the study of musology for it permits us to believe that the vast number of distinct varieties in existence to-day are not necessarily *"sports" from roots* of some ancestral type of by-gone ages.

While no hybridizer may have the courage to attempt to create a new variety from seeds by cross-pollinating two distinct sorts, the expert propagator could undoubtedly, by planting enough seeds, obtain variations and brand-new kinds of seedlings. The existence of perfect seeds in even extremely rare cases, therefore, relieves us from the abominable supposition that the vegetative method of propagation is responsible both for the wonderful *stability* of the present varieties and for the great number

of what we would otherwise have to call "sports" from a few original species.

The number of varieties in the Philippines is probably somewhere between thirty and fifty, although a careful exploration of the interior of Mindanao, Samar, Palawan and the islands of the Sulu group may bring to light a considerable number of additional sorts which are strongly localized; as with the citrus fruits and even the rice varieties, there has been a surprising lack of inter-exchange of varieties between neighboring districts.

There is no special difficulty in banana culture. The plants will, of course, not endure strong winds since the leaves are easily torn and they have no wood in the pseudo-stem, or bundle of leaf-bases; neither can it endure prolonged droughts without showing some effect, although the root-system of the banana is better than that of almost any other crop; in fact, it is so vigorous that some authorities, having noticed the branching effect produced by cutting the roots, have advocated this absurd procedure as a means of increasing the vigor and growth of the plant.

The outlook for a famous future for the banana is excellent. It has been neglected, quite naturally, and is rather conservative, to be sure, but its faults are few and its virtues are almost refulgent when we really get acquainted with it.

MARCOTTAGE: ITS UTILIZATION IN THE TROPICS.

By H. H. BOYLE, *Assistant Horticulturist.*

Excepting cuttage, the only vegetative method employed in the propagation of plants in the Philippines is the method of marcottage, with which, notwithstanding the crude manner in which it is employed by the Filipinos, good results are obtained. Of the asexual methods of propagation, this is, perhaps, the simplest of all, and performed during the rainy season it gives better results with less care than any other; its extended practice may well be recommended where the species used as the stock is of little or no importance. A short résumé of the different methods of marcottage employed in the Philippines, the United States and Europe may, therefore, be of interest.

Marcottage is in Europe known as "circumposition," while in the United States it is commonly known under the term "ringing." The native names for this method of propagation in the Philippines are "balinconcong," "paogát," "paugát," and "pasangã́."

In the conservatories of the United States and Europe the following method is employed in the propagation of such plants as *Ficus elastica, Codiaeum* (Crotons), *Hibiscus,* Cordyline and others when small specimen plants retaining all the leaves around the base are desired within a limited time. The branch or stem to be rooted is girdled a distance of 25 to 40 millimeters in length. The bark in some cases is removed, while in others a number of vertical incisions are made within the horizontal cuts. A small-sized flower pot, which has been broken in half, is then tied in position around the wounded stem with raffia or cord, and the pot filled with a medium of 2 parts soil, 1 part humus, 1 part sand and 1 part live sphagnum moss. The addition of the moss, aside from retaining moisture, insures an even distribution of same to the wound. When suitable roots have been formed to support the new plant, it is severed from its parent, repotted, and kept within a hot frame for a few days, or until it has a thoroughly established root-system.

FIG. 1.—Methods of Binding the Wound for Marcottage in the Philippines. *a*, Coconut husk; *b*, Banana leaf.

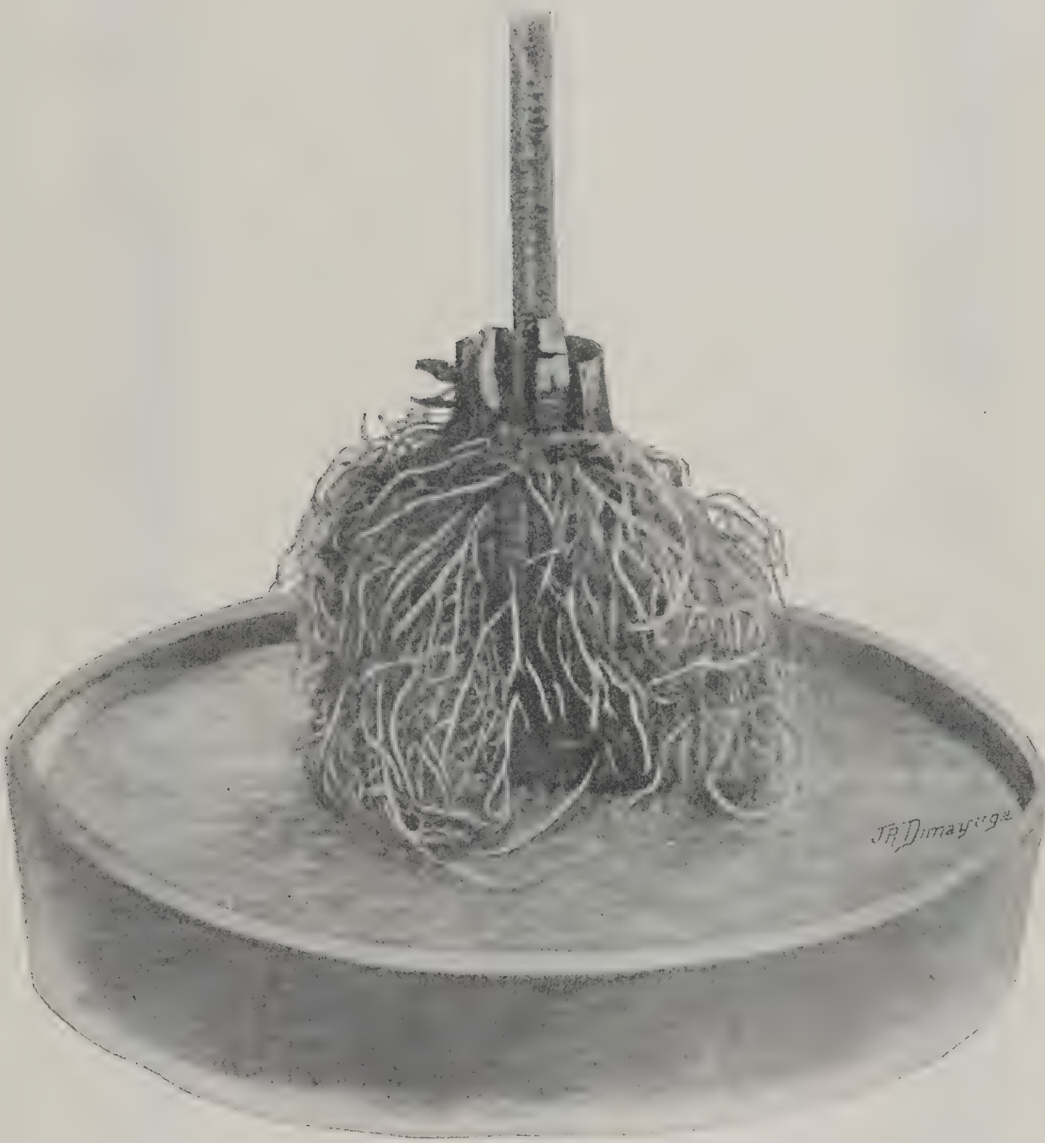

FIG. 2.—Root System Developed in Marcottage by Coconut-husk Method.

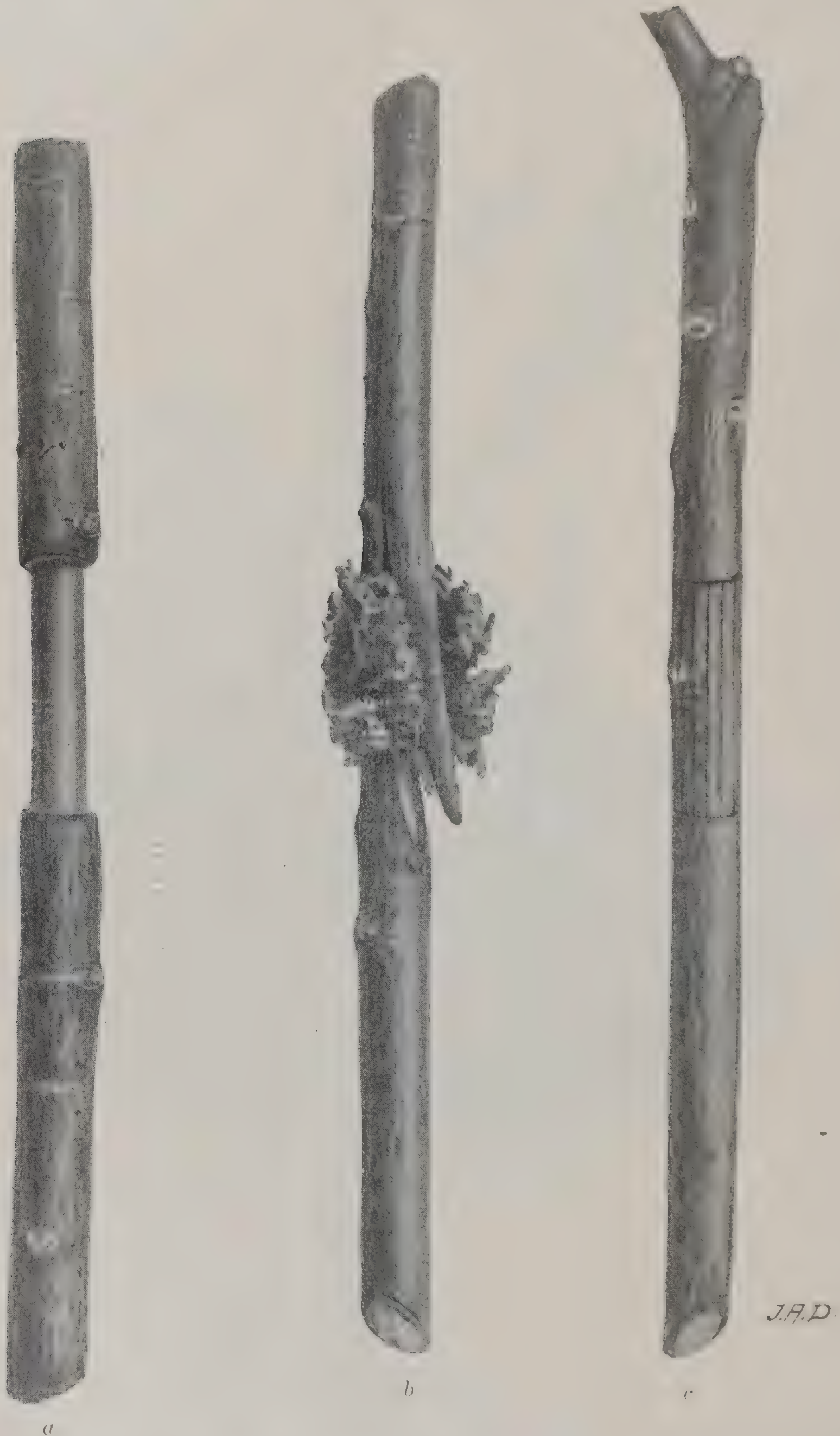

FIG. 3.—*a*, Marcottage Method Employed in the Philippines; *b*, *c*, Marcottage Methods Employed in the United States and Europe.

Another method, which is extensively and successfully used, is as follows: Instead of ringing or girdling the branch which is to be propagated, an oblique incision is made in an upward direction. This incision is usually from 12 to 25 millimeters in length or one-half the diameter of the branch. In this incision is placed a chip of wood of the thickness of a match in order to prevent the healing of the wound, and the wound is now bound up in a small quantity of live sphagnum moss which encourages callousing and the formation of roots. Around the incision is sometimes placed a mixture of live sphagnum moss and clean sharp sand in the proportion of 1 to 6 respectively. This is then bound with raffia or cord. Stiff paper may also be placed in a cone about the moss to hold it in position around the wound. Frequent syringing is necessary to keep the moss in a moist condition so as to encourage root growth. Within three or four weeks from the operation roots will come out through the moss or be seen on the surface of the cone. The scion is then ready to be severed from its parent. The severed portion is now planted in a pot containing light soil and kept in a hot-frame until it is well established.

The following is one mode of propagation in vogue in the Philippines: The branch to be propagated is girdled a space of about 4 centimeters in length at the point where the root-system is expected to form. The bark of the girdled section is then removed and the cambium layer is destroyed by scraping it with the knife. This is done in order to prevent the wound from healing during the period of callousing and of the formation of the roots of the scion. A joint of bamboo, about 15 centimeters long, is now split in half and the pieces placed around the treated branch so that the wound is at the bottom of the tube, after which they are tied together with coconut fiber or other tying material to hold them in position, and the tube filled with soil to induce root formation. When, in the judgment of the propagator, sufficient roots have been formed to support the new plant, the branch is severed from its parent, the bamboo tube is removed, and the severed branch is planted in the garden plat. or placed in a larger tube in a shady place.

Another method, similar to the one described above, is also employed. The difference is that instead of bamboo being used to hold the soil around the girdled section of the branch, a cylinder of banana leaves is placed about the wound. The methods mentioned above are best performed during the rainy season.

In the opinion of the writer a method of binding the wound

with coconut husks employed in some parts of the Philippines in the marcottage of chicos and other plants may well be used extensively, if not universally, throughout the Philippine Islands. The method differs from the one previously described only in that the medium employed to hold the soil and to retain the moisture around the wound is pieces of coconut husks instead of bamboo or banana stalks, and in that a light soil is placed next to the wound to induce root formation. Success has also been obtained by placing only coconut husks about the wound without the medium. Care should be taken that the husk has been thoroughly moistened before it is placed in position; this may be accomplished by soaking the husk in water for a few hours. Within a few weeks of the operation roots will be seen to appear through the sections of the coconut husk and the layered branch is then ready to be severed. The coconut husk is not removed when the plant is set out, but allowed to remain as a part in position. The new plant usually suffers but little when severed from its parent, due principally to the fact that the medium around the roots and the roots themselves have not been disturbed.

The amount of time and care required by plants propagated with the aid of banana leaves, bamboo or sphagnum moss is much greater than that required by this coconut-husk method.

By using the oblique incision instead of girdling the branch or stem and the employment of coconut husks to retain the rooting medium and moisture about the wound, there is obtained such an advantage over the others that the writer recommends this method of propagation in preference to all other methods of marcottage.

The propagation of plants on a large scale by the method of marcottage is practicable in the Tropics only during the rainy season, since when performed during the dry season too much labor is entailed in keeping the coconut-husk coverings sufficiently moist to promote the formation of roots.

RECENT PLANT INTRODUCTIONS INTO THE PHILIPPINES.

By P. J. WESTER, *Horticulturist.*

One of the most important features in the development of a country is the introduction of new plants. Every country has a few species that may to advantage be domesticated, but many regions would be little but uncultivated and worthless deserts, fields or forests except for many plant immigrants, and many necessities and luxuries which add comfort and pleasure to existence would be lacking but for other plant introductions. In this the Philippines are no exception. The Islands are, in fact, the original home of no vegetables and of remarkably few edible fruits, considering their extent and area.

The following species are regarded as indigenous by Dr. E. D. Merrill, botanist of the Bureau of Science: Alubihod, *Spondias mangifera* Wall.; Alupag, *Euphoria cinerea* Radlk.; Bobog, *Sterculia foetida* L.; Cabuyao, *Citrus hystrix* D C.; Calamondin, *Citrus mitis* Blanco; Catmon, *Dillenia philippinensis* Rolfe; Mabolo, *Diospyros discolor* Willd.; Pangi, *Pangium edule* Reinw.; Pili, *Canarium ovatum* Engl.; and *C. pacyphyllum* Perk.

By comparing this list with the annotated lists of Philippine fruits and vegetables on another page, a fair idea may be formed of how much "original material" the Philippines have contributed to the subsistence of the human race, and how much the rest of the world has contributed to the welfare of the Philippines and its people in the way of fruits and vegetables. Most of the food plants in the Philippines have been introduced by the Spaniards, some were prehistoric introductions, and a few have been brought here since the American occupation of the Archipelago. The Spaniards introduced a very large number of economic plants and cereals as well as vegetables and fruits, and it remains for us to complete the work so well begun by them.

When the Insular Bureau of Agriculture was organized in

1902 the introduction and distribution of vegetable seeds of improved varieties became almost at once one of the important features of the work of the Bureau, and this work has gradually grown until some 100,000 packets are now sent out gratis during each season. However, this is only one phase of the plant-introduction work done by the Bureau; the other, the importation of new species, is more particularly the one considered in this paper.

The supply of forage for the Army horses and mules has been a problem ever since the American occupation of the Archipelago, and owing to the great cost at which grain and hay have been transported to the Islands, and because of the obvious desirability of producing these feed stuffs at home, thus effecting a saving of money as well as giving employment to more people, investigations were started by the Bureau with the view of discovering grasses and legumes adapted to the climatic conditions of the Philippines.

In the course of these investigations the native grasses were found to leave much to be desired for forage and attempts were therefore made to import others more suitable.

Among the early introductions the most valuable grass imported was the Guinea grass, which was obtained from Hawaii in 1907. Several varieties of maize, millets, teosinte, and sorghums were also introduced. The velvet bean, introduced about the same year, has proved of greater value than any other legume the Bureau has introduced that has been subjected to extended trials.

While the early forage plant introductions were confined to a comparatively few species, a very large number of both legumes and grasses were brought to the Islands during 1911 by Mr. C. V. Piper, agrostologist in the Bureau of Plant Industry, United States Department of Agriculture, who spent several months in the Islands during that year investigating the forage problem.

The most promising grasses introduced in 1911 include Rhodes grass, Sudan grass, Natal grass and Molasses grass. A large collection of legumes were also introduced, containing many species of *Mucuna* and *Stizolobium*, several varieties of *Phaseolus mungo*, *P. radiatus*, *P. max*, *P. calcaratus*, batao (*Dolichos lablab*), and sitao (*Vigna catjang*). Other species included in this importation were *Phaseolus angularis*, *P. aconitifolius*, *Dolichos biflorus*, *D. atropurpureus*, *Glycine hispida* and *Desmodium tortuosum*. Several of these species will undoubtedly be valuable acquisitions to the forage and cover crops of the Philippines.

More recently Teff (*Eragrostis abyssinica*) has been introduced from Africa and Australia.

Mr. W. S. Lyon, as horticulturist of the Bureau of Agriculture from 1902 to 1907, successfully introduced the following fruits:

Avocado (*Persea gratissima* Gaertn.), the "Chinese Dwarf" banana, caymito (*Crysophyllum cainito* L.), pitanga (*Eugenia uniflora* L.), *Dillenia indica* L., genipap (*Genipa americana*), loquat (*Eriobotrya japonica* L.), bael (*Aegle marmelos*), a superior guava (*Psidium guajava* L.), *Macadamia ternifolia,* and myrobolan (*Phyllanthus emblica* L.). Several varieties of grafted mangos from India, oranges, lemons and pomelos from California, Japan and Australia, improved varieties of pineapples, roselle, ceriman (*Monstera deliciosa*) and several other economics were also introduced by Mr. Lyon; however, because of the frequent change of personnel and other vicissitudes, most of them were subsequently lost. The maté (*Ilex paraguariensis*) was also imported during this period. One of Mr. Lyon's most important contributions to Philippine agriculture during his connection with the Bureau of Agriculture and in fact to that all over the world where this legume will thrive was his domestication and introduction of the Lyon bean (*Mucuna lyonii*). Since he severed his connection with the Bureau of Agriculture, Mr. Lyon has among other fruits successfully introduced the casimiroa (*Casimiroa edulis*), cattley guava (*Psidium cattleyanum*), cherimoya (*Anona cherimolia* Miller), biriba (*Rollinia orthopetala* A. DC.), a spineless lime from Trinidad, and salak (*Zalacca edulis*). Mr. E. R. Case, Singalong, Manila, also deserves mention for the several varieties of oranges and pomelos he has imported from Florida and California of which some will undoubtedly prove valuable; his is probably the first successful introduction into the Philippines of the Scuppernong grape (*Vitis rotundifolia*); an excellent variety of cattley guava is another of his importations.

The first large importation of the Smooth Cayenne pineapple was made during the latter half of the year 1911 when Castle Bross.-Wolf & Sons, Manila, obtained five thousand plants from Honolulu, Hawaii; this was followed by a second shipment of equal bulk early in 1912; the Luzon Pineapple Plantation Co., operating in Nueva Ecija, has recently imported two hundred thousand plants from Singapore of this variety.

Aside from these, perhaps the most prominent introductions made by private enterprise, many Americans, both military and civilians, have brought with them or received seeds, plants, and

cuttings of many plants from the United States, which while unrecorded and unknown at present, may suddenly leap into prominence when they come into fruiting.

With a better organization of the division of plant industry in the Bureau of Agriculture and better facilities for the care of the plants—not that these do not yet leave much to be desired—the Bureau has during the past year probably introduced more plants permanently than during its previous entire history. A plant introduction inventory was started by the writer April 10, 1911, and at the date of writing (May 26, 1912) the inventory already includes 1,666 numbers. However, the accessions have this year grown more rapidly than under normal conditions because of the incorporation into the inventory of previous introductions made by the Bureau which have survived and promise to become valuable acquisitions to the horticultural and agricultural flora of the Philippines. Lest some one may be led to believe that the plants included in this inventory are all new to the Philippines it may not be amiss to state that for convenience of keeping the records of the Bureau all seeds imported in bulk and distributed are numbered, as are also the many new plants that are obtained in the Islands by officials of the Bureau for observation and testing at the experiment stations.

The roselle is easily the leading plant immigrant during the past year. Altogether ten separate introductions have been made of this species. Among these that have been tested at the experiment stations of the Bureau, the growth of three varieties has been all that could have been desired and about three thousand packages of seeds, accompanied by directions for its planting and uses, have been distributed since January, the aim being to reach every municipality in the Archipelago. While it is hoped that this wholesale distribution at one bound will add another combined fruit and vegetable to the table of the Philippine resident, it is also believed that the continued experiments in making flavoring extract and wine from the herbage, inaugurated during the present year in coöperation with the Bureau of Science, will yield results that will eventually lead to the establishment of a new industry in the Philippines. The roselle has primarily been introduced for its culinary value, but two varieties have also been obtained from the Gold Coast, Africa, that appear particularly adapted for the production of fiber.

Realizing the important place the growing of citrus fruits may take in the fruit industries of the Philippines, the introduction

of improved varieties from abroad has been one of the special features of the plant-introduction work of the Bureau during the past year.

A large collection of budded varieties of citrus trees was received in February from Mr. A. C. Hartless, Superintendent of the Botanic Garden, Saharanpur, India, including the following varieties of oranges and mandarins: Ladu, Jaffa, Malta Blood, Excelsior, Suntara, Sikkim, Ami-Kinkan, China, Whitaker, Szinkom, Malta, Kaula, St. Michaels, Kishiu, Konda Narun, Satsuma Mikan, Vanilla, Unshiu, Nagpur, and Seville. Mr. Case, already referred to, has presented to the Bureau budwood of the Marsh Seedless and Triumph pomelos, and the following varieties of oranges: Joppa, Ruby, Pineapple, and Valencia Late. The Pernambuco and Ellen pomelos and the Oneco mandarin have been obtained from Mr. E. N. Reasoner, Oneco, Florida. Lastly the Sampson tangelo, a hybrid between the mandarin and the pomelo, of exceptional merit, has been received from the Bureau of Plant Industry, United States Department of Agriculture.

Including the numerous native varieties and types that have been assembled during the past year, in which work several officials of the Bureau have aided, particularly interesting types have been obtained by Messrs. G. G. Weathersbee in Cebu and E. H. Bahr in Bataan and Tarlac; the citrus collection of the Bureau at Lamao now contains by far the largest collection of species and varieties of any group of plants under observation. A number of these may be expected to become comercially valuable for their fruits; others have been obtained primarily in order to test their comparative value as stocks.

One of the most important introductions is the reintroduction of the avocado, of which three types have been obtained, and about two hundred and fifty plants propagated. Two types new to the Philippines have been secured from California during the past year and budwood of superior varieties has been successfully imported from Hawaii and California. Unlike the roselle, which, being an annual, discloses its value in the course of a few months, the value of the avocados grown from the imported seed probably can not be determined in less than five years, and this introduction is therefore not of immediate value.

The cherimoya (*Anona cherimolia* Miller), by some writers considered to be one of the world's three most delicious fruits, is one of the successful plant introductions of the past year. The writer brought seeds of this species, the mamon (*Anona glabra*

L.), and seeds obtained by crossing the cherimoya with the sugarapple, from Florida in March, 1911. Later in the year several lots of mamon and cherimoya seeds were received from correspondents in Hawaii, Florida, California, and Australia, and more recently budwood of the most celebrated cherimoyas in California from Mr. C. P. Taft, of Orange, and F. W. Popenoe, of Altadena. Budwood of many of the varieties in the cherimoya collection assembled by the writer at the subtropical garden of the United States Department of Agriculture, Miami, Florida, during his connection with that institution, has also been received through the office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry, United States Department of Agriculture. The cherimoya varieties introduced during the year may be expected to fruit in three years.

Among the more prominent plant introductions of the year may also be classed the Smooth Cayenne pineapple of which two thousand plants were received from Mr. J. E. Higgins, horticulturist of the Hawaii Agricultural Experiment Station at Honolulu, and a shipment of the Spanish will probably be in the hands of the Bureau before this goes to press. A few slips of the excellent pineapple hybrids produced several years ago in Florida by Dr. H. J. Webber and Mr. W. T. Swingle under the auspices of the United States Department of Agriculture have also been received from the office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, United States Department of Agriculture.

The importation of a considerable number of grafted varieties of mangos from India is another important feature of the plant-introduction work of the Bureau. The principal aim in procuring these is to obtain varieties that produce larger and more acid fruits suitable for canning, and "out-of-season" sorts.

Two varieties of grapes that succeed well in Hawaii—the Lenoir and Isabella—have been obtained from the Hawaii Agricultural Experiment Station. Superior mulberries have been received from California and Florida and *Morus alba*, the species best adapted to silkworm culture, from France.

The following are distinctly new plant immigrants to the Philippines:

Carissa (*Carissa arduina* Lam.), an apocynaceous, spiny evergreen shrub, native to South Africa, with white star-shaped, fragrant flowers. The carissa is equally valuable for its plum-like, reddish fruits, which may be eaten raw or made into a

preserve, and as a hedge plant for which it is eminently well adapted.

Carica quercifolia Benth. & Hook. A dioecious, tall and quick-growing herbaceous plant, assuming the proportions of a small tree, indigenous to South America. The fruits are oblong, tapering toward the apex, about 10 to 15 centimeters long, yellowish, and resemble somewhat the papaya—to which the species is related—in flavor.

Spondias lutea L. A medium-sized tree of rapid growth, with large pinnate leaves, indigenous to the West Indies, bearing small, yellow fruits—about the size of a plum—in large clusters. Being anacardiaceous, this tree is related to the ciruela, cashew and mango.

Cecropia palmata. A small dioecious tree, of rapid growth, with large, palmate leaves, somewhat resembling those of the castor oil plant, dark green above, silvery beneath. The flowers are borne in a catkins, in the axils of the leaves; these develop to long, slender, finger-like, sweet fruits 15 to 25 centimeters long which may be eaten raw; boiled in sirup their flavor resembles that of preserved figs.

Tiess (*Lucuma rivicoa*, var. *angustifolia* Mart.), a small, evergreen tree, related to the chico, is, like the four preceding species, indigenous to the American tropics; it bears yellowish fruits varying in size and form, from that of a small oblong plum to a goose egg; the flesh is golden yellow, richly flavored and in consistency and taste resembles somewhat the yellow of an egg, hard-boiled and sweetened. The fruit contains one to three large, shining seeds.

Boracho (*Lucuma salicifolia*). A tree resembling in habit and appearance the preceding species and having larger but similar edible fruits. It is a native of Mexico and Central America.

Ceriman (*Monstera deliciosa* Liebm.). A climbing, araceous plant with stout stem, and large, leathery, perforated leaves. The fruits are oblong, 15 to 25 centimeters long, resembling a pine cone; the flesh is white and of delicious flavor. The fruit of the ceriman is nearly always seedless.

Tree tomato (*Cyphomandra betacea* Sendt.). A tall shrub of rapid growth indigenous to Brazil, related to the tomato, with egg-shaped reddish brown subacid fruits that may be eaten fresh, stewed or preserved.

Caranda (*Carissa carandas* L.). A tall, thorny shrub or a

small tree, indigenous to India. The plum-like fruit is eaten raw and is said to make excellent preserves.

Many other fruit-bearing species might be mentioned.

The most important fiber plant introduced during the year is the ramie.

Aside from the plant introductions above referred to a very large number of species of ornamental trees, shrubs, and herbaceous plants and palms have been received, most of which have been distributed to correspondents interested in such plants.

The above discussion will give some little idea of the activity of the Bureau relative to plant-introduction work. Valuable as many of these new introductions will undoubtedly prove to be in the course of time to the country and its people, less expense is entailed in procuring many of them than is the cost of many other phases of work by the Bureau, much material being obtained in exchange for seeds or plants peculiar to the Philippines that are desired by our correspondents in other countries.

The plant-introduction work of the Bureau of Agriculture has, however, only just begun. With better facilities that are planned for the care of plants at the experiment stations it is also planned to import a great number of new fruits and other economics that grow in other countries but are still unknown in the Philippines, many in fact scarcely known outside of those countries to which they are indigenous. Among the Anonaceous plants there are for instance about a score producing edible fruits, most of which are unknown outside of their native habitat; the same is true of a very large number of Myrtaceous fruits indigenous to the American tropics, Brazil in particular. There are also new bananas to obtain from Hawaii, tropical Asia and Polynesia, a large number of citrus fruits from Florida, the breadfruits from Polynesia, not to mention such plants as the mangosteen, Durian, Rambutan and other related species that while growing in Mindanao and the Sulu Archipelago still remain to be acclimatized in other islands in the Philippines.

BUREAU STATION REPORTS FOR APRIL.

LA CARLOTA EXPERIMENT STATION, OCCIDENTAL NEGROS.

Although some parts of this province are still dry, we have had our quota of April showers (some 6.3 centimeters). This enabled us to begin planting.

The following seeds have been planted in plats: Twenty-two varieties of soy beans; twenty-one varieties of other legumes, including nine from Cebu, four from Bayombong and one from the Catanduanes; three varieties of Kafir corn; and three varieties of Milo. Eight varieties of grass have been transplanted from boxes to nursery beds.

A few plats of guar, cowpeas, mongos, and soy beans have been harvested. These had all been planted during the dry weather and yielded small crops of seed.

On April 16 we finished the first cultivation of about 25 hectares of our best ratoon cane. This is expected to furnish all the green fodder we shall need for four or five months beginning next October.

Thirteen varieties of experimental cane in plats which were irrigated a few times during the prolonged dry spell are now doing very nicely.

Before the showers came 2 hectares of Guinea grass were revived by irrigation and sufficient forage has been cut daily to feed our stabled animals and give the fifty-seven head of brood mares and colts—which are on native grass pasture—one feed a day. For the sake of economy the grass is put through a feed cutter run by water power.

Notwithstanding the very unfavorable weather for abacá, the ten varieties which Mr. Saleeby brought to this station from Davao last January are looking fairly well. They have been irrigated at intervals of from seven to ten days.

One mestizo colt dropped on the last day of the month was the only addition to our horses during April. He is out of an American Army mare, A-42, by native stallion No. 77.

Native stallion No. 53 is almost entirely recovered from the complaint from which he has been suffering for several months.

Two Indian mestizo calves sired by Nellore bull L-31 have been added to our herd. One young Indian bull was sold during the month. Two half-Spanish goats have produced three kids. These are three-fourths Spanish, having been sired by imported Spanish billy A-103. There has been no increase in either the carabaos or hogs.

Lantana has received the undivided attention of six laborers during the whole of the month. There is probably enough left to keep the same number of men busy for two weeks longer.

Approximately 15 hectares of land have been plowed preparatory to planting. (*H. J. Gallagher, Superintendent.*)

TRINIDAD GARDEN, BENGUET.

The work at Trinidad Garden is divided into three phases: Extension work, which consists of distributing seeds and plants to the people of the surrounding country and stimulating their interest in agriculture; the experimental work, which consists of trying new plants and new varieties of plants already introduced; and the supplying of Baguio people with vegetables and fruit. Of these three, the last mentioned requires the most attention and may be considered as being the most important.

The interest taken by the people of this portion of the country in having gardens of their own is very encouraging and, I believe, is largely due to the influence of this station. The plants with which they have the most success are cabbage, peas, lettuce, radishes, turnips, strawberries and string beans. These do not by any means exhaust the list but are probably the most important. These vegetables seem to be grown more for the Baguio market than for the purpose of adding to the home diet.

A crop which seems to be gaining great favor with the Igorrotes is the American sweet potato obtained originally from the United States Department of Agriculture; it is now well adapted to conditions here by having been carried through three generations on this place. It is satisfactory both as to quantity and quality, facts which have been noted by the Igorrotes, many of whom work here, and as a result it is now being planted quite extensively. The vegetables and fruit grown on this place are delivered in Baguio three times a week, Tuesdays, Thursdays and Saturdays. On these days two wagon loads of produce are taken in and delivered at the homes of the people by whom they were ordered. The list of produce which was delivered last month is as follows: Lima beans, string beans, beets, beet greens, cabbage, carrots, carnations, cucumbers, kohl rabi, let-

tuce, mulberries, peas, radishes, roses, spinach, strawberries, turnips and turnip greens. Area considered, all of these crops bore very satisfactorily with the exception of strawberries. This, however, should not be construed as indicating that strawberries are an unsatisfactory crop for this location. The fact of the matter is that the typhoon of September 27, 1911, one of the most unusual and severe which has ever been experienced here, wrought such havoc in washing out some plants and in covering others that a large portion of the beds had to be replanted after that date, and as a consequence the plants are too young as yet to bear heavily. Now, however, the production is increasing at a very satisfactory rate and it is expected that there will soon be an abundance of berries. (*Austin M. Burton, Superintendent.*)

LAMAO EXPERIMENT STATION, BATAAN.

The work carried on at this station during the past month has been largely that of continuing the experiments already in progress, as follows: Citrus propagation; papaya selection and breeding; roselle tests; top-working old mango trees; yam and legume trials; and pineapple, coffee, abacá, corn and tropical-fruit experiments. During the month just past, operations have been mainly confined to work on the first six of the projects mentioned.

Due to the unfavorable soil conditions prevailing at the Singalong experiment station for the propagation of citrus stocks, it was deemed advisable by Mr. P. J. Wester, horticulturist of the Bureau, to transfer the citrus stock under cultivation there to this station. There are now several thousand young seedling citrus trees growing here, some of which have already been budded with superior varieties of oranges, lemons and pomelos, from budwood received from the United States. It is expected that additional budwood will be received in the near future, and upon its arrival more seedling stock will be budded. After the budded trees have attained a proper growth, it is planned to use them in making a citrus grove, and later to propagate budded trees for general distribution, thereby, it is hoped, improving the citrus-fruit production of the Islands. Recently a large shipment of a number of different varieties of citrus trees was received from India. These trees will be fruited, and in addition budwood will be taken from some and budded on the more vigorous citrus stocks that are growing in the nursery.

Under the supervision of Mr. Wester, work to improve the

quality and fix the type of the papaya fruit has been started. A large number of seedling papaya plants are now growing at the station, from which selection will be made with reference to the shape and quality of the fruits produced on the different plants. From the fruits nearest the standard of perfection seeds will be sown and plants propagated. In addition to selection as a means of perfecting the quality and fixing the type, breeding work will also be employed.

The different varieties of roselle are being tested here to determine the best time of the year for planting and for maximum growth. One hundred square meters of the "Rico" variety now growing on the station is being tested for its yield of herbage to determine the practicability of growing it on a large scale for the purpose of manufacturing sirup, wine and allied products. The two cuttings thus far made, only three weeks apart, have given satisfactory results. Experiments are also being made with several varieties of roselle to determine their fiber-producing qualities.

There are a number of old mango trees at the station which have been severely pruned or "topped." The tree is thus induced to send out young shoots just below the severed portion, and in these shoots will be placed buds of a superior variety of mango. The mango trees thus pruned have already sent out the young shoots and are ready for budding, which will be done in the near future.

The object of the yam experiments is to determine, by means of growing and testing all the different varieties obtainable, the ones that are best adapted for human consumption. A large number of different kinds of yams have been received from all parts of the Islands, from the United States Department of Agriculture, and from various other sources. The experiments are being carried on under the "Barrett Planting and Cultural Method."

In addition to the above briefly discussed projects, the legume trials, pineapple, coffee, abacá, corn and tropical-fruit experiments have of course received attention during the past month with respect to cultivation and irrigation. (*F. C. Kingman, Acting Superintendent.*)

THE BICOL FARM, VIRAC, CATANDUANES.

The Bicol Farm, comprising two and a half hectares of land with stable, was turned over to the Bureau of Agriculture January 1, 1912, by the people of the southern part of Catanduanes

Island for use as a breeding station. It is located 3 kilometers from the town of Virac.

Planting on the farm is very much retarded by the drought which has continued for some time with only scant interruption. It is practically impossible to plow with the means at hand. A large amount of work, however, has been accomplished in grubbing and fence building. With the installation of a pump considerable planting can be done with the aid of irrigation.

Of the forage crops raised so far, cowpeas and Guinea grass have resulted best. With irrigation it will be possible to cut the Guinea grass monthly. The soil, which is a clayey loam, appears to be exceptionally well adapted for this crop. Corn has been grown to some extent for green feed.

The people appear to be well satisfied with the result of last year's breeding and are very proud of their "mulas," a term applied here to the mestizo colts. Some disappointment is expressed now and then on account of the colts not always coming true to the color of the stallion. There are as many mares presented as can be handled with safety to the horses. During the month we had seventy original and thirty-one return services, a total of one hundred and one for the four horses stationed here. A large number of colts are being brought to the farm for treatment suffering from an infection of the navel, due to lack of care at birth.

It has been found of great advantage to change the feed to palay now and then, this having the effect of turning slow and indifferent workers into active animals. In the case of the Arabian horse "Pharaoh," this has been the means of changing an otherwise "dead" horse into a first class worker.

During the month the writer made an inspection of the station at Bagamanoc and found things quite satisfactory considering the fact that only native horses are stationed there and that on account of the condition of the trails only some three hundred and fifty mares are available.

In Pandan what appeared to be a serious outbreak of glanders was found and twelve animals were placed in quarantine. A large number of castrations were effected on this trip.

After one year's work among the people of Catanduanes, especially in the southern part of the Island, the formerly very prevalent disease of lymphangitis has practically disappeared in the vicinity of Virac and it is hoped that within another year the whole of the main island will be free from it. (*E. H. Koert, In Charge.*)

TRINIDAD STOCK FARM, BENGUET.

The most noteworthy feature of the work performed at this farm during the past month has been the routine duties of looking after the stock which the Bureau has assigned to this station for breeding purposes. The chief portion of the time, however, has been, and is, devoted to the care of cows that have calved. We have also been quite busy destroying the cattle ticks which have become so numerous of late. I can say that our efforts have met with partial success, and I have every reason to believe that we will be able in the near future to eradicate this pest. The formula which has been employed at this place for the purpose of destroying cattle ticks is as follows:

Arsenic trioxid, commercial	pounds	8
Sodium carbonate, crystallized	do	24
Yellow soap	do	24
Pine tar	gallon	1

Dissolve the arsenic in 20 to 30 gallons of water by boiling thirty to forty minutes. Add water to make 100 gallons. Dissolve the soda in 20 to 30 gallons of water; dissolve the soap (shaved) in the soda solution; pour the tar into this in a fine stream, stirring at the same time; mix the two solutions; add enough water to make 500 gallons. (This formula was introduced here by Dr. Gearhart.)

The cattle are sprayed every ten days with this mixture.

During the past month we have been getting the fences in good condition before the rainy season begins, as it will be impracticable to do this after the rains commence.

This year's breeding was started on April 15, and the thirty-two Mestizo cows and heifers have been placed with an Indian (Nellore) bull. The twenty-one Chinese cows are with an Angus bull. The Galloway bull has with him four selected mestizo cows.

The undersigned is of the opinion that the calves next year will be born at closer intervals than has been the case this year; this will be due to the fact that all cows were placed with bulls on the same date.

The extreme drought which has existed for the past few months has been broken by two good rains during the past week; these rains were 3 and 5.7 centimeters respectively. Although these rains were quite generous in this locality there was only a slight precipitation in Baguio.

The grass will no doubt improve wonderfully in the next few days, and this will likewise better the condition of the herds, which subsist entirely upon grass at this farm. (*A. L. Bradley, Acting Superintendent.*)

CURRENT NOTES[1]—JULY.

POSSIBLE FUTURE PLANT INTRODUCTIONS.

The Pomona College Journal of Economic Botany for February, 1911, contains a most interesting and well illustrated paper on the Botanic Garden of Pará, Brazil. The wealth of plantlife in the large valley of the Amazon River is well represented in the Pará Botanic Garden. Many strikingly ornamental plants found there have not yet been introduced into other parts of the world. Of the greatest interest are perhaps the following tropical fruits, all of which are practically unknown outside of Brazil and one only of them, the biriba, has been introduced into the Philippines:

Mangabeira, *Hancornia speciosa* Gom.
Amapa, *Hancornia amapa* Huber.
Uchi, *Saccoglottis uchi* Huber.
Umari, *Poraqueiba sericea* Tul.
Castanheiro, *Bertholletia excelsa* HBK.
Piquia, *Caryocar villosum* Pers.
Inga cipo, *Inga edulis* Mart.
Pajura, *Parinarium montanum* Aubl.
Parinari, *Couepia chrysocalyx* Bth.
Sorveira, *Couma guyanensis* Aubl.
Oity, *Moquilea tomentosa* Bth.
Abiu, *Lucuma caimito* RS.
Cutiriba, *Lucuma rivicoa* Gaertn.
Baury, *Platonia insignis* Mart.
Bacury-pary, *Rheedia macrophylla* Planch & Triana.
Biriba, *Rollinia orthopetala,* A. DC.
Jaboticaba, *Myricaria cauliflora* Berg.
Grumixama, *Stenocalyx brasiliensis* Berg.
Araça do Pará, *Britoa acida* Berg.
Cupuacu, *Theobroma grandiflorum* Schum.
Pupunha, *Guilielma speciosa* Mart.

[1] Original notes prepared by various members of the Bureau of Agriculture.

The Bureau of Agriculture has recently entered into correspondence with several scientific institutions in Brazil and in due time we hope to see several of the above fruits in the Philippines. (*P. J. Wester.*)

BANANA COLLECTION.

After having made a preliminary survey and census of the Philippine bananas and plantains, the Bureau of Agriculture is now contemplating the establishment of as complete a collection of these fruits as possible. Correspondence is solicited with all who are interested in getting together a collection of these valuable fruits, which shall be excelled by none in the world.

No material should be sent to the Bureau, however, without previously advising the Director of Agriculture, and receiving his reply.

In exchange for rare varieties of these fruits the Bureau purposes to furnish seeds and seedlings of other economic plants; in some cases, of course, it may be necessary to purchase the banana suckers. With the earnest coöperation of Philippine planters and with ordinary success in the line of exchanges with other countries, it is hoped that we shall have 100 varieties growing in this collection within two years. (*O. W. Barrett.*)

BANANA DISEASE.

The tropical banana disease which has caused such heavy losses to planters in Costa Rica is gradually spreading to the famous Bocas del Toro district of Panama and to Dutch Guiana, Trinidad, and Jamaica. Especially in the Island of Jamaica, whose prosperity depends so largely upon the banana crop, every effort is being made to check the spread of the disease. The affected plants are cut down, the roots dug up, and the entire material, together with the soil about the roots, is treated with lime and exposed for some time before any attempt at replanting is made. Even the feet of all persons and animals passing through the plantations are disinfected in order that the specific bacteria which cause the disease may not be carried to the adjoining estates. (*O. W. Barrett.*)

A NEW OIL.

Italy has recently given the world another new vegetable oil. The Province of Parma annually conserves some 84,000 tons of tomatoes. The seeds, although really constituting but a small percentage of the residue from the canning factories, yield a

considerable quantity of oil somewhat resembling that of cotton seed. At least 600 tons of tomato-seed oil have appeared on the market, and it is probable that other countries will follow the economic example of Italy. (*O. W. Barrett.*)

FORMOSA, OUR NEW RIVAL.

The canning industry of Formosa has recently taken a distinct turn for the better. The principal pineapple-canning factory there is now capable of handling 10,000 cases of 2 dozen cans each per annum. On account of the new customs tariff, which was put into effect in July, 1911, the pineapple industry virtually enjoys a monopoly at present.

A Japanese confectioner in Tainan, South Formosa, claims to have discovered a process by which the banana may be canned, and has interested several wealthy Japanese with the result that a ₱200,000 company has been organized to build two factories, one in Tainan and the other in Taihoku. Since it has heretofore seemed to be practically impossible to conserve any kind of bananas in tins or jars, the result of this new process will be watched with great interest by the Philippine planters; should it succeed this Archipelago will have another very promising industry—providing patent rights can be obtained. Experiments should be made along this line in the Philippines.

Orange planting in northern and southern Formosa is now on a sure footing; some of the plantations are subsidized by the Government. (*O. W. Barrett.*)

THE STUPENDOUSNESS OF COPRA.

It is stated, on good authority, that the present European output of coconut-oil margarine is approximately 1,000 tons per day. We cannot realize what this enormous quantity means, but but when we consider that it is enough to supply 20,000 hotels using 5 kilos each per day and 3 million families using 2 pounds of vegetable butter each per week, we get some conception of the tremendous importance of this new staple food product.

However vast as this quantity is which goes into tinned butters, I estimate that it accounts for only about one-half of the total amount (some 700,000 tons per annum) of the copra received at the coconut-oil factories of the world. The copra-export figures are now *more than double those for dairy-butter exports.* (*O. W. Barrett.*)

ANOTHER COPRA DRYER.

In *Tropical Life* for February, 1912, the editor, Mr. H. Hamel Smith, puts before the public a modified form of the old "dry-house" kiln. The plan is simply to force hot air by means of ventilator fans into the building at the bottom and out at the top; inside the building there may be four to six perforated or lattice-work floors, one above the other, upon which the raw material is spread. The large amount of floor space compensates for the somewhat longer time required in completely drying out the material.

The difficulties of this system are: To obtain an adequate supply of hot, dry air without at the same time admitting smoke from the fuel (husks and shells, of course) furnace; economical handling of the material inside the building; and the initial expense of constructing a large drying room (with perhaps "half an acre" of floor surface) which should be practically insulated from the cooling effect of rains, winds, etc., together with the machinery for running the ventilating fans. The advantages are the enormous quantity of material turned out at each discharge, evenness of quality, freedom from scorching troubles, and the remarkable cheapness of operation.

In the same number of *Tropical Life* appears an article on "The Philippine Coconut Status" by the author of this Bureau's coconut bulletin. In view of the recent phenomenal increase in Philippine copra exports, however, the figures given in the said article are altogether too low for our present output. (*O. W. Barrett.*)

NEW COPRA COUNTRIES.

Trinidad, in the British West Indies, has recently begun to export copra. We recently gave notice of the installation of a copra dryer in British Guiana, but it appears now that Trinidad is rapidly gaining over that colony, its export for 1911 being some 1,000 tons. In 1907 the writer inspected a small, but very economical and profitable coconut-oil and copra plant in the southern peninsula—in sight of the gigantic palms in the delta of the Orinoco River of Venezuela. The principal export in this line from Trinidad is, of course, the raw nut, of which some 19 millions are exported yearly.

With the growing demand for coconut-oil products and the advantage of reducing the bulk of shipments, it is almost certain that there will soon be plenty of copra plantations not only in

Trinidad, but in Jamaica, the Guianas, and probably in Santo Domingo—providing the bud-rot, which is now rapidly destroying the coconut industry in Cuba, does *not* spread to these countries. (*O. W. Barrett.*)

ANOTHER NEW FOOD-PRESERVING METHOD.

From the United States Consular Reports, we learn that there is before the public a new Argentine process of preserving meats, fish, and vegetables. The invention, which is patented, is said to consist in the preparation of a *fluid* which may be used by the housewife as well as in large establishments. It is said to contain no antiseptics or any other substances injurious to health. (*O. W. Barrett.*)

SAGO.

The Administrator of the Territory of Papua (New Guinea), Mr. Staniforth Smith, has recently made a remarkable trip of exploration through the previously unknown Western District of that Colony, and finds that the sago palm, which in the Philippines appears to be confined to the lowlands, grows there up to an elevation of more than 1,000 meters. With the supplementary crops of breadfruit, bananas, yams, and sweet potatoes, the wild tribes of the interior of Papua live on sago as the *pièce de resistance.*

Mr. Smith's discovery will undoubtedly create considerable surprise among horticulturists and will result in the sago palm being placed in a still higher class of economic plants. Though probably confined to districts having a fairly heavy and well distributed rainfall, there is not much doubt but that sago could be grown throughout the interior of Mindanao, and probably in most other mountainous districts of the Philippines, especially along watercourses. Since this palm, unlike most others, *suckers from the stump,* a plantation once established needs very little attention, as is proved by the famous sago forests on the Agusan River in Mindanao. These forests, if economically exploited, would supply annually many thousand tons of a food practically as nutritious as rice.

In passing, it is of interest to note that in the said Western District of the Colony, maize is unknown and coconuts are exceedingly rare except on the lower reaches of the larger rivers; mangos are unknown and, strange to say, cassava has not yet—after probably a thousand years—found its way back into the interior. On the other hand, the natives cultivate several very interesting vegetables and fruits of their own, which will now

within a few years be introduced to the general public. (*O. W. Barrett.*)

RUBBER AND BUTTONS.

Why does the price of rubber affect the price of buttons?

Without understanding something of the labor conditions of South America, it is difficult to connect these two ideas, but, as a matter of fact, there is a reciprocality in the prices.

The virgin forests of Equador, Southern Colombia, and Western Brazil contain almost unlimited amounts of taqua, the palm-like, short-stemmed tree which produces the vegetable-ivory nuts of commerce. The nuts are gathered by the Indians living in the jungles, and "packed" to the coast towns; donkeys or mules are used on the more open trails, but the back of the Indian, too, must bear the heavy loads down to the roadways. Providing the Indians have what they consider proper wages as "seringeiros," or rubber gatherers—that is, if the rubber agents in the Andean jungles can afford to offer a *good* rate, the natives become rubber tappers; otherwise, they put a larger supply of taqua upon the market.

Some six years ago the writer investigated this subject and found that the commercial value of these nuts was some 15 million pesos per annum, although most commercial firms estimated the value at only a small fraction of that amount. Most of the raw material goes to Germany, where, especially in the town of Schmolln, the nuts are sawn, cut, and polished—by female operatives.

In Colombia a rich sweetish paste made of the contents of the unripe nuts is a common food in the markets of the interior during a considerable portion of the year; it is known as "Pipa de Jagua," and resembles the "jelly" of half-ripe coconuts. Millions of buttons are thus lost to trade through the Indians' appetite for this rare natural "dulce": such are the freaks of commerce!

Recently the taqua, or corozo, has a rival in trade—the "palma dum" kernels from Africa. A few trees of these vegetable-ivory palms are found in the Philippines; at the San Ramon Farm near Zamboanga may be seen some fine specimens. Unless some of the new button materials, such as "ivorite," "galalith," and "steinan" can be turned out more cheaply, it is possible that within a few years we may see plantations of the button palm here in the Philippines. It appears that a small quantity of button kernels are now being shipped from some of the Pacific archipelagos. (*O. W. Barrett.*)

FERTILIZERS.

Most Philippine soils are improved by organic fertilizers. Many sections of the Archipelago could readily establish fertilizer plants utilizing fish-refuse, sharks, and even certain varieties of fishes which are not of much value as food.

Russia, realizing the possibility of this industry, has erected at Baku a large factory for the handling of fish-waste with the idea that this will enable Russia to supply practically all of the domestic demands for this kind of fertilizers. (*O. W. Barrett.*)

A MAIZE BULLETIN.

Perhaps never in the history of the Philippines has there been such a severe drought as the one through which the Islands have just passed. Such drought means failure, if not utter absence, of all irrigated crops, especially rice. Fortunately, however, there are a few crops which can be grown under drought conditions, or at least with a very slight rainfall; many varieties of both Kafir corn and maize will endure considerable drought; and again there are a great number of varieties of these crops which are very early, that is, only 50 to 70 days from the time of planting are required to get crops.

During the last few years the tremendous importance of maize has become evident in the Visayas, and it is bound to come, soon, we hope, that the maize habit will grow upon all other districts of the Archipelago.

The Bureau of Agriculture has for the past six years been striving to interest the planters, especially in Luzon, in the advantages of growing one or two crops of maize per year on practically all kinds of cultivated lands. If this system were followed, the troubles and real dangers of shortage in the rice crop would be very greatly lessened.

In furtherance of this policy the Bureau is now publishing a maize bulletin which will, it is believed, serve as a guide to the planters of the Philippines in this line of agriculture. The bulletin covers all phases of the industry from selection of seed and testing of same to the storage and handling of both the grain and forage. This bulletin has been prepared by Mr. S. H. Sherard who has had several years' experience in maize growing in various provinces of the Archipelago. (*O. W. Barrett.*)

AGRICULTURE NOT WITHOUT HONOR.

Dr. Inazo Nitobe, Ph. D., the distinguished scholar whom the Government of Japan sent to America recently to lecture to the leading Universities there on the new questions in and the development of his country, made the following statement concerning the status of the farmer in Japan: "With us agriculture was, even in early times, held in the highest esteem. The four social classes into which according to their occupation people were divided comprised the samurai (warriors in the front ranks), then the tillers of the soil, followed by artisans and traders. It was not unusual for the tiller of the soil to pass into the ranks of the samurai, or for the samurai to engage in farming without detriment to his dignity." (*S. H. Sherard.*)

INCREASING INTEREST IN ANIMAL INDUSTRY IN THE TROPICS.

During the past three years Japan has purchased over 300 bulls, mostly of the Kankreji type, from India. Brazil and other South American countries are importing large numbers of several races of zebus. A Cuban cattle breeder is considering the importation of Gujerat cattle into that Republic.

Some two hundred or more years ago a few Senegambian bulls were introduced into Porto Rico by the Spaniards. This race of cattle, which happens to resemble somewhat the famous Africander cattle of central South Africa (and which may be a distinct subspecies), has succeeded splendidly in that Island; and Jamaica, recently becoming interested in the cattle business, is now importing these Porto Rican bulls, which are still of more or less pure West African blood, for crossing with the native Jamaican cattle.

Although Cuba has spent millions of pesos for sugar-estate mules in the last three decades, very little effort has been made toward the breeding of these animals in that Island. The central agricultural station at Santiago de las Vegas is now maintaining a special breeding stud, however, and it is expected that the industry will increase rapidly, since it has been demonstrated that first-class mules *can* be raised there. Porto Rico has also begun mule breeding in earnest.

It is understood that there is a considerable demand for hinnies in lieu of mules in Mexico and the south western section of the United States; it is claimed that the hinny is just as hardy and sure-footed as the mule, while being somewhat easier to raise. (*O. W. Barrett.*)

PLATE I.—COCKS OF RHODES GRASS FOR THE NIGHT DURING CURING

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Agricultural Review

VOL. V AUGUST, 1912 No. 8

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

AGRICULTURAL DEMONSTRATIONS.

In 1904 the United States Department of Agriculture started its agricultural demonstrations for the instruction of a few farmers in western Texas. Seven years later a force of six hundred agents was employed on this work, and instructions were being given to one hundred thousand farmers in thirteen different states. It would be quite impossible to measure the results obtained, but the rapid growth of coöperative demon-

stration work and its enormous development within a period of a few years furnishes some indication of its value.

The object of agricultural demonstration work is to furnish a means of reaching and influencing the men on the farms. The essential features of this work are that the agents come in personal contact with the farmers; the farmers participate themselves in the demonstrations; and, under normal conditions, there is practical certainty of success.

In the future development of agriculture in the Philippine Islands, demonstration work promises to play an important part. This work is already well established in several different provinces and is receiving the hearty support of the people. About fifty demonstration plots are now being cultivated in the Provinces of Cebu and Iloilo, and there is an urgent demand that the work be extended.

Demonstration work is deservedly popular for the reasons that it is practical, and that it produces definite and positive results. The farmer who, with his own hands, grows a larger and a better crop under the supervision of a demonstration agent does not have to be convinced by argument that this work is practical. The results are before his eyes, and the profits are in his own pocket as soon as the work is finished.

THE SPANISH EDITION OF THE PHILIPPINE AGRICULTURAL REVIEW.

From various communications received by the Bureau of Agriculture in regard to paid subscriptions to the Spanish edition of THE PHILIPPINE AGRICULTURAL REVIEW, it appears that there is more or less hesitancy in subscribing on the part of some people desirous of obtaining copies in Spanish, through the fear that this edition will be done away with in the near future.

To eliminate this uncertainty, it may be stated that, from present indications, it is very improbable that the Spanish edition will be discontinued for some time to come.

If, in the course of time, this step should become necessary, one of two things would be done: Either the Spanish edition would be continued until all outstanding subscriptions should have terminated, or, if this were impracticable on account of a small number of subscribers, these few subscriptions would be refunded. Thus there could be no possibility of loss on the part of a subscriber to the Spanish edition.

There are to-day throughout the Philippine Islands a large number of people who can make an intelligent and advantageous use of the English edition of the REVIEW, and this number is

constantly increasing from year to year in direct proportion to the increasing enrollment of pupils in the public schools of the Philippines. These English-speaking people, however, are in the main confined to the younger or coming generation of Filipinos.

On the other hand, there is a large number of people in this Archipelago who are to-day, and will be for many years to come, an important factor in the political and industrial development of the Philippine Islands, and yet who are not conversant with the English language. Reference need only be made to the fact that the majority of provincial Filipino officeholders and the greater part of the large landowners belong to this class. These are men for whom the school-day period has passed, and who do not have the inclination or the time to take advantage of the present opportunities for learning English.

The editors of the REVIEW feel that it would be a mistake to ignore this important element in the present-day life of these Islands, and it is with this idea in view that it has been decided to continue the publication of the Spanish edition. It is to be hoped that this policy will be appreciated, and that the Bureau of Agriculture, through the REVIEW, will thus be able to materially assist the farmers of to-day, as well as those of the future.

BUREAU OF AGRICULTURE CIRCULAR NO. 15—THE MANGO.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

THE MANGO.

By P. J. WESTER, *Horticulturist.*

(Circular No. 15. Manila, February 7, 1912.)

INTRODUCTION.

The mango is undoubtedly the most esteemed of all the Philippine fruits and yet its cultivation, notwithstanding the luxuriance with which the tree grows, can be said to be scarcely in its infancy. It has been estimated that under ordinary conditions only 23 per cent of the mango trees yield a satisfactory return; this is due partly to neglect, but principally because the trees are all seedlings, and when certain insects, destructive to the bloom and fruit, appear, this yield is still further reduced. However, by taking the proper measures as outlined in this circular, by topworking the old trees, by planting only budded orchards, and by combating the insect pests, it is believed that the yield of fruit can be greatly increased.

PROPAGATION.

General remarks.—Planting the seed "at stake," that is, where the tree is to remain in the orchard, and planting the seed in a bamboo tube, later to have the plant set out in the field when it has attained a height of 20 to 30 centimeters, with a view to budding or grafting the plant as soon as it is well established and sufficiently large for the purpose, are probably the most preferable methods of starting an orchard for the average planter of mangos in the Philippines.

Unless properly cared for the mango seed rapidly loses its vitality and should therefore either be planted within a few days after the fruit is eaten, or if this is not convenient, the seed

should be placed in a box and covered with moist earth, sand, or sawdust, until it can be planted.

The nursery.—If it is planned to grow the plants in a nursery, this and a seedbed should be prepared by grubbing the soil thoroughly to a depth of 30 centimeters, carefully removing all stones and trash, and if the soil is poor it is well to incorporate with it some well decayed stable manure, compost, or lacking this, a complete commercial fertilizer.

Plant the seeds about 10 centimeters apart in the seedbed, laying them flat on the ground and covering them 1 to 2 centimeters with soil. If planted deeper the seed frequently decays instead of germinating, particularly in heavy soils. When the plants are about 15 centimeters high transplant them to the nursery, about 20 to 30 centimeters apart in rows 1 meter or more apart, to suit the planter's convenience. Trim off about two-thirds of the foliage of the plants before the transfer and prune back the tap root to a length of 10 or 15 centimeters. Unless the transplantation has been preceded by a good rain, water the seedbed thoroughly and, if possible, perform the transplanting on a cloudy day or late in the afternoon. Unless the work is performed during the rainy season when the land is abundantly moist and the rains frequent, the plants should be well watered after they have been set out.

The seed may also be planted directly in the nursery rows, but whether they are planted here in the seedbed or "at stake," it is well to mulch the ground well with straw or leaves after having planted the seed. It is likewise well to mulch the nursery after the plants have been set out there. If the seed is planted direct in the nursery the plants should be gone over when about 15 to 20 centimeters high, and a sharp spade thrust into the ground diagonally under each plant severing the tap root 10 to 13 centimeters from the soil surface. This will induce the formation of a better root system and facilitate the transplanting of the plant from the nursery to the orchard.

Budding and grafting.—The reasons why the mango grower should bud or graft his trees are several: (*a*) The trees are rendered vastly more productive; (*b*) fruit of any given variety may be produced; (*c*) the season of ripening is to a large measure under control; (*d*) the trees are apt to fruit earlier; (*e*) the trees become more or less dwarfed and thus the fruit is gathered more easily and insect enemies are controlled with greater facility.

There are several methods of converting an ordinary seedling tree into one that is more desirable. Those most adaptable to

Philippine conditions are the Pound method of shield-budding and the Gale method of grafting.

In budding the mango select well-matured budwood—that which is still green and smooth and has the buds well apart—from the first, second, and third flushes from the terminal bud. In trimming off the leaf and petiole let about 15 to 20 millimeters of the thick, fleshy part of the petiole remain attached to the bud until it sheds voluntarily, for if the petiole is cut too near the bud, fungi frequently enter the bud through this entrance and destroy it.

The stock is suitable for budding when somewhat larger in diameter than a lead pencil. The buds should be inserted at a point where the bark is green and smooth, *i. e.*, of the same character as the budwood, and the work preferably performed when the plant is in flush. First make a vertical cut about 5 centimeters in length in the stem, and, according to whether the bud is to be pushed up or downwards, make a horizontal cut at the lower or upper end of the vertical cut, trim off the edge of the horizontal cut to facilitate the insertion of the bud and lift the bark by passing the point of the knife gently up and down between it and the wood so that the bud can be inserted without undue pressure and attendant crushing of the tissues. Cut the bud rather large, 3 to 5 centimeters long, taking care not to break or tear the tissues. For this reason it is always well to use a knife made especially for the purpose of budding. (See fig. 1.) In order to obtain the best results it is also essential that the edge of the knife be keen as a razor and that the blade be clean.

After the insertion of the bud into the incision in the stock, wrap the bud firmly, without strangling the stock, with grafting tape; allow the remnant of the petiole to stick out between the strands of the tape and place a square piece of wax cloth, held in place by the tape, above the petiole to protect the projecting petiole from dew, rain and from drying out by the hot sun; girdle the stock about 15 to 20 centimeters above the bud after it is tied. After the bud has "taken," which usually takes place in the course of two or three weeks, unwrap the tape to below the leaf-bud and prune off the top at the point of girdling. In order to force the buds to grow, look over the plants frequently and rub off all adventive buds.

The above method may be used equally well in the nursery, the field, or in topworking old trees; for the preparation of the latter, see under separate paragraph.

FIG. 1.—The Pound Method of Shield-budding the mango. (*a*) Budstick, (*b*) bud inserted, (*c*) bud tied, (*d*) bud, (*e*) budding knife (reduced).

The Gale method of grafting is principally adapted to the working over of seedlings in the field from those six months old to small trees having a diameter of about 5 centimeters; larger trees are *topworked* to greater advantage. Take a scion 30 to 45 centimeters long and, after having removed nearly all the foliage, expose the cambium layer for about 7 centimeters by paring off the bark smoothly with one cut with a sharp knife; perform the same operation on the stock, a few centimeters from the ground; now place the scion so that the 2 cut surfaces make a good fit, tie with grafting tape, and heap moist soil around the stock and scion well above the point of juncture, allowing only a few centimeters of the top of the scion to be exposed above the soil. As soon as a good circulation of sap between stock and scion has become established gradually remove the top of the stock.

TOPWORKING OLD TREES.

In topworking old trees it is first necessary to provide for a suitable "stock" in which to insert the buds. For this purpose prune off the main branches of the tree that are expected to carry the new top about 30 to 60 centimeters from the trunk, and leave the weak and poorly-developed branches to shade the trunk and branches and to maintain the circulation of sap until the new top has formed. In the course of a few months a number of sprouts will issue from the stumps of the old branches of which the strongest should be budded and treated as already described under budding plants in the nursery. When the buds have "taken" and made a good start, gradually remove all other shoots and the branches that were left when the pruning was done until finally the top consists only of the buds inserted. All wounds should be covered with a coat of linseed oil and white lead, or coal tar as second choice, or if these materials are not available, use clay and dung mixed. In cutting off large branches, it is always well to have the cut sloped a little so that rain and dew do not long remain on the cut surface. Never apply so much paint or coal tar that it runs down the limb.

CULTIVATION.

Soils.—The mango will grow on any kind of fairly-drained land not too shallow; it luxuriates on rich moist soils having good drainage and it does not suffer from an occasional inundation. However, a poor soil that is fairly deep is best adapted for the production of fruit. An annual rainfall of 1,250 to

2,500 millimeters mainly occurring from June to October is most suitable for the mango.

Clearing.—In setting out a mango orchard the land should preferably be cleared a year previous to the time when it is planned to set out the trees. If the land is covered with timber the stumps should be removed and the land planted with a leguminous cover crop. The roots of this will open up the soil, add humus and nitrogen, and altogether put the land in good condition before the plants are ready to be set out.

An orchard may also be started by clearing away the timber and largest growth from the ground, after which the land is staked and a circular area cleared around each stake where a tree is to be planted. As the trees increase in size, the circle in which they stand should be enlarged until ultimately the land is entirely cleared.

Planting.—It is well to dig the holes for the trees a few weeks in advance of the time of planting. Make the holes about 60 to 80 centimeters wide and 40 to 50 centimeters deep. In planting the trees fill the holes with surface soil instead of the acid subsoil dug out of the holes, and work in the soil carefully among the roots allowing them to remain in as natural a position as possible. The mango should never be planted deeper than it stood in the nursery. To prevent excessive evaporation until the trees have become established, it is well to prune away about two-thirds of the foliage and all tender growth; it is also of benefit to cut leafy branches and stick them in the ground around the young plant for shade. Mulch the plants heavily.

An orchard may also be established by planting seeds "at stake" where the trees are to remain, with a view to budding the young plants or topworking them after they have become of some size. This method has much to recommend it, particularly for those not well versed in the transplantation of trees and plants. If this method is adhered to it is well to plant 3 or 4 seeds together in each "hill" to insure a good stand; as the seeds germinate all but the best plant is thinned out in the hill.

No mango orchard should be planted out less than 10 meters apart between the trees and a distance of 12 to 15 is preferable. Aside from varietal variation in vigor, the fertility of the land, prevalence of moisture in the soil, and the amount of precipitation are factors that should be taken into consideration when the distance is decided upon, as influencing the development of the trees. It should be kept in mind as well that where it

becomes necessary to combat insect enemies or diseases by fumigation or spraying, the trees should stand sufficiently far apart to permit the work to be executed conveniently.

WINDBREAKS.

The mango is so admirably adapted for a windbreak that to plant other nonfruiting trees with this end in view would be wasting space, for even if some fruit is lost through the exposure to the wind more or less will always mature on the trees. For windbreaks only the most vigorous varieties should be planted.

COVER OR SECONDARY CROPS.

Where a leguminous cover crop is wanted, the velvet bean, Lyon bean, cowpea and related species may be used with good success. Of these the Lyon bean is preferable in the Philippines, since it produces a greater amount of growth per acre here than any other legume.

The seed of the Lyon bean and cowpea should be planted preferably in drills to admit of cultivation until the plants are established. About 20 liters of seed of the Lyon bean is sufficient for one hectare; 180 liters of cowpeas will plant the same area if sown broadcast, or if drilled, one-fourth that amount will suffice.

The considerable distance between the mango trees necessarily leaves much land unoccupied for several years; this may be planted profitably with what is usually called secondary, or catch crops. These may consist of small, quick-growing, early-bearing fruit trees, pineapples, field or garden crops. There is not the slightest danger of their being injurious to the mango trees, provided that the cultivation is not carried so close to the trees that the work animals injure them or the cultivators tear or break their roots; in fact, it is beneficial in that the constant stirring of the soil aids in rendering plant food available to the plant that hitherto may have been unavailable. Among the fruits that may be recommended for this purpose may be mentioned the banana, papaya, the citrus fruits, the sugarapple and related plants, etc. The trees should be planted one in the center of each square, or as many in one hectare as there are mango trees. If the mango trees are planted out at the maximum distances, one secondary tree may be planted between each 2 mango trees and one in the center of the square. Where fruiting shrubs are used as a secondary crop, these should be planted in rows, and may be set out in the interspaces about 1.5 meters apart, maintaining a distance of about 4 meters from a mango

to a shrub; these shrubs being planted in rows between the mangos, they would not for some years inconvenience the planter. Bananas and papayas should be planted about 3 meters apart in the interspaces.

By the growing of secondary crops between the mango trees their cultivation is already provided for during the early stages of the development of the grove.

When the trees have grown large and entered their fruiting stage, leave the land entirely uncultivated during the dry season except for the stirring in of the fertilizer.

FERTILIZERS.

The soil in the Philippines is in general sufficiently rich in all elements for the development of the trees, in fact it seems to be too well supplied with nitrogen and, in consequence, the trees develop top at the expense of fruit. To counteract the influence of this superabundant nitrogen supply in the soil, it seems reasonable to believe that better crops of fruit may be produced by judicious applications of fertilizers containing phosphoric acid and potash when the trees become of fruiting age. These applications should be made from September 1 to about January 1, and not during the spring or summer months.

During the first few years after the trees have been set out, well decomposed stable manure applied to the trees would considerably hasten their development, but when the trees are of fruiting age it is better not to use it except on very poor soil.

USES OF THE FRUIT.

The mango is essentially a dessert fruit, yet it has many other uses. Excellent mango sauce, very similar in flavor to that made from the apple, may be made from the full-grown *unripe* mango. It is prepared by peeling the fruit, slicing the flesh, and boiling it together with a little water, adding sugar to taste.

Jelly.—Peel the mango as it begins to turn yellow, before it softens; slice the pulp from the seed; pour enough water in the pan to cover the fruit, and boil until quite tender; strain through muslin cloth; to this juice add an equal quantity of sugar and boil till it jellies. Lime juice may be added if more acidity is desired in the jelly than is present in the mango.

Marmalade.—The pulp left after the juice has drained off in making jelly is now run through a fine sieve; boil with an equal quantity of sugar, adding a little lime juice to make it firm, until it thickens like cheese. (Marmalade, of course, can also be made direct from the fruit, *i. e.*, with its own juice retained.)

It has been stated that if the mango seed is boiled together with the preserve, the preserve will retain the flavor of the fresh mango. The seed, of course, is thrown out when the preserve is put up in jars.

Mango preserve.—Select mangos just showing color, peel and slice; to each kilogram of fruit, use 1 kilogram of best white sugar and 2 teacups of water; boil the sugar and water until it drops from the spoon very heavy, then pour it over the fruit and let stand until cold; pour off the sirup and boil down as before; when the sirup is quite thick, drop in the fruit and boil hard for twenty minutes, or until the sirup remains thick. Seal at once.

Aside from these uses, the mango may be candied, made into chutney, or pickled.

MARKETING.

Where the fruit is handled properly it seems that its shipping qualities are very good, fruit shipped from the West Indies to England and France, and even from India to London, arriving in good condition. Ventilated crates, 30 by 30 by 60 centimeters, containing a dividing board in the center, and 2 trays of a thin board to distribute the weight, would probably be found to be a suitable package in the Philippines. Great care should be exercised in the handling of the fruit from the time it is picked until it is packed, in order to reduce the number of spoiled fruits to a minimum. Each fruit should be wrapped in soft tissue paper before it is put into the package, and care should be taken to see that no fruit can move about after the crate is nailed up.

DISEASES, AND INSECT ENEMIES.

No serious disease affecting the mango has yet been reported in the Philippines. The different parts of the mango tree are affected by a number of insects, the majority of which do not, however, seriously injure the plant.

At the present time one of the most serious insect pests of the mango is the mango hopper, a small, wedge-shaped insect that inhabits the mango trees throughout the year, and which, as the trees come into bloom in the spring, multiply some years in such large numbers as to sometimes destroy a great part of the mango crop for that season by sucking out the juices of the tender flowerbuds and flowers, which in consequence wither and drop.

Remedies.—On account of its feeding habit, the insect is difficult to destroy without injury to the flowers; the contact sprays in Circular No. 12 are recommended experimentally for the control of this pest.

Another serious pest of the mango in several parts of the world are the fruit-flies, of which there are several species. At least one species exists in the Philippines that does considerable damage; the exact amount of the loss caused by this insect is difficult to estimate from the fact that as soon as the infested fruit drops to the ground it is eaten by the numerous hogs that are present everywhere, and undoubtedly this fact assists greatly in keeping the pest in check.

Remedies.—Gather and burn, or bury, 1 meter deep, all refuse fruits and "drops" under the trees, and where they become especially troublesome, spray the trees with the Mally Fruit-fly remedy. (See Circular No. 12, p. 4.)

It is recommended that the first application of this spray be made a month before the presence of the larvæ in the fruit is expected, and thereafter an application every ten to fourteen days until the flies have disappeared. In the application of the spray, direct the nozzle so that the liquid falls in small drops over and through the tree.

There are two unidentified species of *Lepidoptera*, the larvæ of which work considerable destruction to the mango: One that enters the young tender terminal growth and hollows it out after which it withers and dies; another larva, probably the same species, has also been found to work much destruction to the mango flowers in the flowering season; considerable damage to the mango flowers is also caused by a larva that feeds on the surface of the flower stems with the effect that they shrivel and die. These insects, as yet unidentified, are together with the mango hopper, and the unidentified fruit-fly already referred to on a previous page, the principal and, as far as known at present, the only serious insect pests on the mango in the Philippines. A remedy for the larva just referred to can not be recommended until the life history has been studied further.

For a full discussion of the control of fungi and insect enemies, see Circular No. 12.

O. W. BARRETT,
Chief, Division of Experiment Stations.

Approved:
C. M. CONNER, *Assistant Director of Agriculture.*

NOTES ON FORAGE PLANTS IN JAVA AND INDIA.

By C. V. Piper,

Agrostologist, United States Department of Agriculture.

Climatic conditions in Java are so similar to those in the Philippines that the Dutch method of feeding cavalry horses becomes of particular interest. At Padalarang there is a large cavalry remount station where a large number of horses imported from Australia is kept in reserve. These animals each receive about 25 kilos of green grass and 5 kilos of palay daily. This ration keeps them in excellent condition judging from their appearance at the time of my visit. The green grass consists of a number of native species, among which zacate so well known in Manila is considered the best. Some Guinea grass grown by natives near the remount station is also used and efforts are being made to increase this supply. Some of the wild grasses, notably carabao or bitter grass (*Paspalum conjugatum*), are usually refused by the horses.

Alongside the remount station is the horse-breeding farm, the object of which is to improve the native horses which are identical with the little trotters so well known in Manila. According to the director of the station, Dr. Groeneveld, these horses are all originally from Sandalwood Island (Soemba) and are, therefore, often called Sandalwood ponies. There are historical records of the fact that these horses were well known three hundred years ago and even then were shipped to the various islands of the Indo-Malayan region. According to Dr. Groeneveld the evidence is also trustworthy that these horses are the descendants of a shipload of Arabian horses. On Sandalwood as well as on Madura there are extensive areas of grass-lands, thus making these islands especially well adapted to stock raising. Most of the beef used in Java comes from these islands. In Java as in the Philippines the constant tendency has been to sell the best horses to the cities, with the consequence that the breeding for the most part was from the inferior animals retained

in the country. The object of the horse-breeding station is to maintain the excellent form and trotting capacity of the native animals and to increase their size by crossing with Australian horses. Many of the native horses used in breeding are exceedingly fine examples—their beauty of form, high spirit, and grace of movements would make any lover of horses enthusiastic. Second-generation crossed animals indicate that the desired object of increased size without diminution of trotting ability will be secured. As fast as possible the cross-bred stallions will be used throughout the country to bring up and maintain the breed.

Dr. Groeneveld has a patch of alfalfa of which he is very proud, and which he has now maintained several years. The alfalfa is planted in rows to permit of cultivation, as otherwise the weeds soon destroy it. The secret of his success is heavy liming of the soil and inoculation, combined perhaps with the altitude, where no great extreme of heat occurs. From Dr. Groeneveld's success I have no doubt that similar results can be had in many places in the Philippines, but it would probably be unprofitable for any farmer except a dairyman, and then only in places where lime or crushed limestone is cheap.

At Karanganyer is a cattle breeding station where there are many fine examples of Indian cattle. The station seems to me not very well adapted to the purpose, as there is very little grazing land in the vicinity and so far as I could learn no cattle industry. The only feed grown is *Panicum numidianum*, a grass very similar to Pará grass. It is quite likely that this grass may prove better than Pará in many places, especially where the ground lacks much moisture. A supply of seed was secured to test in the Southern States and it should also be tested carefully in the Philippines.

The common grass all over western Java is *Polytrias præmorsa*, which makes a close sod like Bermuda and furnishes good pasturage. About Batavia and other cities this is the principal lawn grass in the parks. Its only objectionable feature is its somewhat purplish color. A little of it is now introduced about Manila and it shows a decided tendency to spread. It is one of the grasses that offers promise in improving the pasturage on cogon lands. Cogon by the way is not a very common grass in Java, and in India is decidedly scarce, being replaced by a larger species, *Imperata exaltata*, which also occurs in the Philippines.

In the matter of lawns I was especially impressed with the

excellence of the grass cover in the deep shade of trees at the Botanical Garden of Buitenzorg. The best of these grasses is *Paspalum marginatum*. As some difficulty is had in shady lawns at Manila I would suggest experimenting with this grass.

Conditions in Ceylon, at least in the southern mountainous region, are much like those in western Java, the soil in both cases being reddish. Pará grass, under the name Mauritius grass, is quite largely grown and constitutes the principal green fodder sold in Colombo. I heard no complaint of it being troublesome as a weed, as has been the case in Jamaica and other West Indian Islands.

In India considerable quantities of hay are put up at so-called grass farms. The farm at Saharanpur is typical. The native grass here consists largely of *Andropogon annulatus* and *Pennisetum cenchroides*, though numerous other species make up part of the crop. It is these grasses that are cut for hay just after the monsoons are over in September, and the quality of the product is considered very satisfactory. Besides mowing the grass little is done at these farms, though it is considered advisable to plow them about every five years. No grass seed is ever sown in India so far as I could learn, and the only properly cultivated grass consists of patches of Guinea grass and alfalfa. In the main the roughage animals receive is green feed, wild grass when that is available, and juar (sorghum) during the dry season. For grain feed cavalry horses usually receive a mixture of juar (sorghum) or barley and some bean, either horse gram (kulthi) or Bengal gram (chick-pea). The hay put up at grass farms is in part an emergency ration in case of need in field operations. Where green feed is available it is usually fed as roughage, or a mixture of green feed and hay is used.

None of the numerous wild grasses of the Ganges Valley and other parts of India would pay to cultivate in competition with better tropical grasses, such as Rhodes, Sudan, Guinea, and Pará, but many are of sufficiently high quality to be of great value in the Philippines provided they would spread naturally. Inasmuch as species of Alysicarpus (mani-mani) common in the Philippines also occur in the Ganges Valley, and from the further fact that the climatic conditions are very similar to central Luzon, a wet season and a dry season, it is quite likely that these grasses will find themselves perfectly adapted to Philippine conditions. The introduction of aggressive grasses of good quality that can maintain themselves in the cogon lands and better

Plate II.—HAULING RHODES-GRASS HAY FROM FIELD TO BARN.

the pasturage is a matter of great importance and sooner or later one that will require thorough investigation. *Pennisetum cenchroides* would seem to be of especial promise in this connection, but many of the better Indian grasses should be tried.

Juar is the great cultivated fodder crop of India—but only the stalk and leaves are thus used, the grain being a food for human consumption. The fodder is not as good as that of the sweet sorghums, such as Amber and Sumac, and the grain is not as good as maize—so I can see no reason to introduce juar into the Philippines.

The horse gram or kulthi is an annual legume extensively grown after the manner of cowpeas, and the grain forms a part of the concentrated ration of most horses in India. I see no reason why it should not succeed well in Luzon, planted just after the close of the wet season, but whether the yield of grain per acre would be profitable only experiments can decide.

Bajri, or what is called in America Pencillaria, is much cultivated in India both for the grain and for forage. There is no doubt that it will succeed well in the Philippines, but the fodder is not as good as sorghum. Furthermore, the birds are exceedingly destructive to the grain—to prevent which the native prepares a platform in the middle of his field where he stays all day no matter how blistering the sun may be.

Ragi (*Eleusine coracana*) is also a very important crop in India, furnishing large yields of an inferior grain like millet. The forage is also comparable in value to millet. With scarcely a doubt it will succeed perfectly in the Philippines, but it is doubtful whether the people would take to its culture.

Throughout India the rule is to have fields in mixed cultures, such as juar and cowpea; juar, castor beans and cowpeas; castor beans and cotton; cotton and kulthi or mung; etc. Each of these crops is harvested separately, a matter made possible by the extremely low value attached to labor. Where a legume is grown in the mixture the philosophy of the practice is evident. Where no legume is grown it is claimed nevertheless to be a good practice, as one plant may fail owing to a lack of timely rains or other causes, while the other will survive these mishaps—and a partial crop is better than no crop. Whether there be merit or not in the practice it is one of the most interesting features of native Indian agriculture.

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PHILIPPINE KAPOK: A PROMISING NEW INDUSTRY.

By M. M. SALEEBY, *Fiber Expert.*

The kapok tree is widely distributed throughout the tropical world. Here in the Philippines it is well known to any person who has traveled at all extensively through the provinces. The date and other information relating to its introduction here have not yet been determined, but it can safely be said that the tree has been grown here for at least one century, judging from the extent of its distribution throughout the Archipelago. With the exception of Java, where a few regular kapok plantations have recently been started, we seldom see a large number of trees grown in close proximity. Here in the Philippines the trees are frequently to be found growing along roadsides and borders of fields which are planted in some other crop. Only very recently it was reported that several attempts are now being made in different parts of the Islands to start the growing of kapok on a large scale and in a regular and systematic manner.

The fiber which is obtained from the pods is extensively used by the inhabitants of these Islands and other tropical countries for filling pillows, cushions, mattresses, and for other similar purposes. This domestic use has been made of the fiber from a remote period. Its production and exportation on a large scale, however, did not commence until a comparatively recent date when the Dutch in Java first made known to the commercial world the admirable qualities of the fiber. Here in the Philippines, where the introduction of the kapok tree was perhaps simultaneous with its introduction into Java, no attempt had been made to export the fiber prior to 1905; even now it can hardly be said that the fiber is exported on a large scale. The following statistics will serve to show the extent to which this industry has been developed in Java, in comparison—or rather in contrast—with its development here in the Philippines:

EXPORTS OF KAPOK FROM JAVA.

	Tons.		Tons.
1889	1,125	1900	3,500
1890	1,500	1901	3,800
1891	1,950	1902	3,500
1892	1,450	1903	4,400
1893	1,250	1904	4,675
1894	1,625	1905	6,300
1895	1,930	1906	5,875
1896	2,250	1907	8,250
1897	1,875	1908	6,900
1898	2,725	1909	8,000
1899	2,600	1910	7,930

The exports of kapok from the rest of the Dutch East Indies during the year 1910 were 695 tons, which, added to the quantity exported from Java for the same year, makes a total of 8,625 tons for the whole Dutch East Indies.

The exports of kapok from the Philippines are as follows:

Fiscal year.	Quantity.	Value.
	Tons.	
1905	4	₱614
1906	13.5	1,652
1907	37	6,842
1908	27	13,590
1909	10	1,194
1910	30	5,804
1911	98	22,648

Yield and value.—Owing to the fact that all the kapok trees growing in the Philippines are given little or no attention and are planted in a haphazard manner, no definite estimate of the yield of fiber can be given. From several observations made by various officials of the Bureau of Agriculture, a conservative estimate of the annual yield of the fiber per tree may be placed at from 1½ to 2½ kilos from trees under seven years of age. After the seventh year, however, the yield increases to 3½ or more kilos per tree. From three to five hundred pods is considered a fair annual yield from one tree under seven years of age. Trees over seven years have been known to bear as many as one thousand pods, but this is considered beyond the average. The pods also vary in size, and while in some cases only sixty pods yielded one pound of clean fiber, in others it took as many as one hundred and twenty, or more, to yield the same quantity. The weight of the seed obtained from the pod is, generally speaking, a little less than double the weight of the fiber. Experiments with a certain number of pods have shown that the yield of fiber varies from 58 to 65 per cent of the weight of the seed.

The principal world market for kapok is Amsterdam, Holland, which is the distributing center for a few other European countries. Australasia and the United States come next to Holland as buyers of this fiber. The fiber is usually sold in the Amsterdam market under three principal grades, namely, extra cleaned, good cleaned (or prime Java kapok), and cleaned (second quality). The latest quotation for the extra cleaned grade was reported to be 50 cents Dutch currency per pound, equivalent to about 85 centavos Philippine currency per kilo. The difference in price between each of the three grades mentioned above ranges from 9 to 13 centavos per kilo. The fiber is sometimes sold with the seed intact and it is then classified as good uncleaned or ordinary uncleaned. The local price of the seed should be in the neighborhood of ₱36 to ₱45 per ton. The Philippine kapok, when properly cleaned, compares favorably with that from Java. Several samples forwarded by the Bureau of Agriculture have been quoted at 15 to 16 cents United States currency per pound (66 to 70 centavos per kilo) for the ordinary grade; with a more careful cleaning of the fiber, it is believed that it will easily bring 18 to 19 cents per pound (79 to 83 centavos per kilo).

The following data will serve to show the gradual rise in the value of kapok during the last decade:

Exports of kapok from the Dutch East Indies.

Year.	Quantity.			Value.	
	To United States.	To Australasia.	To Holland.	Approximate maximum value in U.S. currency per pound.	Approximate minimum value in U. S. currency per pound.
	Tons.	*Tons.*	*Tons.*	*Cents.*	*Cents.*
1890		400	800		
1900		900	1,800		
1901	17	1,430	2,100	6	
1902	75	1,270	1,450		
1903	280	1,130	2,300		
1904	600	975	2,670		
1905	1,520	1,700	2,600	13	12
1906	1,285	1,690	2,270	15	12
1907	1,450	2,610	3,700	18	14½
1908	1,700	1,700	3,050	15	14
1909	1,720	2,260	3,730	14½	12½
1910	1,800	2,370	3,550	16	
1911				18	
1912				20	

Uses.—Among the filling fibers of commerce, kapok ranks first. This fiber is short, brittle, and of great and durable elasticity. The first two render it unsuitable for weaving purposes, but for upholstery and other similar purposes in which elasticity constitutes an important factor, the last quality renders it eminently suitable.

For filling purposes, therefore, kapok now enjoys a wide variety of uses, which are constantly increasing in number as the admirable qualities of the fiber are being gradually and steadily revealed to the commercial world. The two principal uses of the greater part of the product are the following, in their order of importance: First, for filling cushions, mattresses, and other similar articles of upholstery; and second, for buoyant cushions.

For upholstery purposes kapok is preferred to all other filling fibers on account of its great capacity for filling and also its great elasticity. The latter characteristic is demonstrated by the fact that all cushions and mattresses that are filled with kapok will, after the pressure is taken away, resume their previous dimensions. In other words, kapok does not get matted with use, as is the case with the other filling fibers. Its great capacity for filling is shown by the fact that the weight of kapok necessary to fill a certain mattress is considerably less than that of any other fiber used for the same purpose. This is proved by the following table [1] in which is given the weight of several filling materials necessary to fill one single mattress 6⅓ by 12 feet (2 by 3.75 meters):

	Pounds.	Kilos.
Kapok	17.6–19.8	8.096– 9.108
Horsehair	26.4–28.6	12.144–13.156
Seaweed	33.0–35.2	15.180–16.192
Wood shavings	33.0–28.0	15.180–12.880
Crin vegetal	26.4–28.6	12.144–13.156
Alpine grass	25.4–28.6	11.684–13.156
Straw	28.6–82.0	12.880–37.720

The use of kapok in buoyant cushions dates back to a very recent period, prior to which cork was almost exclusively used. Now the former is gradually replacing the latter, and it is only a matter of few years when kapok will be used to a greater extent than the latter for this purpose. Until a few months ago, Philippine kapok was generally considered inferior to the Java product, and while small quantities of it have been for several years used for upholstery purposes in Europe and the United States, its use in life-saving appliances was practically forbidden in the United States. Circular No. 226 of the Department of Commerce and Labor, entitled "Regulations of Motor Boats," dated May 22, 1911, specifically required the use of prime Java kapok.

[1] Taken from a publication issued by the department of agriculture in Java, and entitled "What Kapok Is and What it is Used for."

This naturally put the Philippine product out of the market, and consequently a protest against this restriction was made by the Philippine Government, through the War Department, under date of February 2, 1912. The justice of this protest was so plain that the Department of Commerce and Labor at once issued circular No. 236, dated February 15, 1912, which superseded the former and in which it was required that "buoyant cushions shall be capable of sustaining afloat for a continuous period of twenty-four hours an attached weight so arranged that whether the said weight be submerged or not there shall be a direct downward gravitation pull upon such cushions of at least twenty pounds." On receipt of this information, and at the request of the Secretary of Commerce and Labor, two samples of Philippine kapok were sent to Washington by this Bureau, to be tested as to whether they would meet with the above requirements. The results of these tests are given in the answer of the Secretary of Commerce and Labor, from which the following quotation is taken:

> Two tests of the Philippine kapok were made in the same manner as tests of kapok in cushions previously submitted.
>
> One pound of the Philippine kapok was sewed up in a cover made of imitation leather cloth, the weight of which cover when submerged in water was about nil, and iron with an actual downward pull of 20 pounds when submerged in water was attached to the cushion and the whole placed in water.
>
> One of the cushions thus weighted floated more than 1 day and 9 hours, and less than 1 day 23 hours 30 minutes. The other cushion floated under the test more than 1 day 8 hours and 30 minutes, and not more than 1 day 23 hours and 30 minutes. The exact length of time that the cushions floated was not determined, for the reason that the cushions were left floating at close of office hours, with no one to watch same.
>
> The two tests show that the Philippine kapok tested fully meets the requirements of the regulations of this Department, contained in Department Circular 236, entitled "Regulations of Motor Boats."

Another use that is destined to influence to a considerable extent the development of the kapok industry is as a filler for bandages in surgical dressings. For this purpose it is gradually coming into favor, for it possesses all the requisites such as lightness, elasticity, dryness, and suitability for dry sterilization.

Conclusion.—The above and other minor uses made of kapok will explain its gradual rise in price. The Philippine planters in general are as yet ignorant of the full merits of this product, and the object of this paper is to show them plainly that kapok, of which large quantities are annually allowed to rot in the fields, can, with comparatively little expense and trouble, be gathered,

cleaned, and marketed at a cost that will allow of substantial profits.

Heretofore, the principal drawbacks to the production of kapok for export purposes have been the ignorance of the producers as to the full merits and value of the fiber in the markets of the world, and also the lack of suitable machinery for cleaning it. The first cause has now been eliminated by this Bureau, and due information has been given to both producers and buyers. As to the second cause, it can be said at present that this has, so far, been only partially provided for. One machine has been in operation for the last few years, and has given fair results; another is now being experimented with, with fair prospects of success; and still another is, we understand, under construction. The plans for this last one have been secured from Java by this Bureau and, at the request of an engineering firm in Manila, turned over to them for construction.

A careful review of the statistics showing the production and value of the Java kapok will conclusively prove that a serious attempt toward the establishment of this industry in the Philippines is justified. The Bureau of Agriculture is well satisfied with the outlook for this industry, and several communications have recently been received by it from a number of manufacturers in the United States who are desirous of handling the Philippine product and who have quoted prices ranging from 14 to 18 cents United States currency per pound, laid down in New York or San Francisco. These facts, together with the facility of raising kapok in the Philippines and its freedom from any dangerous enemies or diseases, should recommend to the attention of the Philippine planters, as well as the Philippine buyers and exporters, the advisability of building up this industry and endeavoring to supply the larger part, at least, of the American and the Australasian markets. The Java product enters the United States market free of duty; and our product must, therefore, for the present at least, compete on even terms. As regards the Australasian market, both Java and the Philippines are also on the same footing; this is no reason, however, why the latter should not be able, in the near future, to supply a large part of the demand in the neighboring British colonies.

NOTES ON THE PROPAGATION OF RHODES GRASS FOR HAY.

By Dr. H. F. HUNGERFORD,
Superintendent Alabang Stock Farm.

Each year there is imported into the Philippine Islands the large amount of 25,000 tons of timothy hay, valued at ₱1,300,000. It is therefore of the greatest importance to determine whether a satisfactory hay grass could not be grown in the Islands. With this object in view the Bureau of Agriculture undertook the propagation of Rhodes grass, which appeared to be suitable for this purpose.

Rhodes grass (*Chloris gayana*) has been grown with great success in such widely separated regions as South Africa, Florida, Hawaii, and Australia; therefore, there seems to be no valid reason why it should not be produced commercially in these Islands, as its propagation is neither difficult nor expensive. While it prefers light sandy soil and so would be adaptable to the immense plains of central Luzon surrounding Mt. Arayat, it, however, will produce good crops averaging seven tons to the hectare in a season on heavy gumbo soil.

The market price of timothy hay is about ₱89 per ton. Rhodes grass may be produced for about ₱52 per ton, leaving a profit to the producer of ₱37 per ton; with proper care and attention this grass will surely give a comfortable annual income to the grower.

Methods of propagation.—Various methods of propagating Rhodes grass have been tried since the first importation of seed was received in 1911.

In all cases, irrespective of the method of planting used, it should be remembered that owing to the fine nature of the seed, the land must be brought to the finest tilth possible; an abundance of water must be supplied until the plants have become firmly established, and thereafter at moderate intervals.

After a year's experimental work with the propagation of this forage plant it is still too early to state positively the best method of propagation, but a few of the methods tried on the Alabang stock farm may be mentioned.

Probably the best results were obtained by sowing the seed broadcast in plats varying from 10 to 15 meters wide.

The width of these beds will have to be determined by the nature of the soil; where it is loose, friable, and easily "washed," or where the grades are steep, narrow beds are to be preferred; on the other hand where these conditions do not prevail the widest bed possible is the best.

Having located a suitable piece of ground sloping gently in two directions, if possible, the main irrigation ditch is laid out following the greatest slope of the land; next, and at right angles to it, are laid off the laterals, their distance apart determining the width of the plat. The plats between the laterals are now worked up and harrowed over to remove all clods; where the land is of clay and inclined to be lumpy, it may be irrigated, and, when dry, if harrowed, the clods will readily break up.

When a fine tilth has been produced, water is admitted to the main ditch and then to the laterals in small quantities. The lower banks of the lateral canals are opened at intervals and the water allowed to flow into the plats, care being taken that the force is not sufficient to cut channels in the soil. In fact, the water should rather soak through the soil than flow over the surface. (See Fig. 2.)

After the plats have been well soaked (and they should be thoroughly wet, as the seed is rather slow in germinating, and if irrigated before it is well sprouted much of the seed will be lost), the seed is sown broadcast and not too thinly over the plats; it is then raked in with an ordinary garden rake or even a board set at right angles to a long stick will answer the purpose. The seed should germinate in from five to seven days. After it is well started it may be irrigated again, and subsequently as often as may seem necessary.

At first weeds and other grasses should be removed but once the Rhodes grass has taken a firm hold it will shade out all other plants.

Other methods of growing this grass have also been tried, though none are as satisfactory as that already mentioned.

The seed may be planted in rows similar to Guinea grass, the rows being spaced 6 decimeters apart. This allows room for the passage of cultivators and irrigation. This method is

not recommended, however, as the grass grows much more coarsely and is therefore less suitable for hay. Where the grass is already planted in this manner it is suggested that the rows be filled in by transplantation, thus converting the field into a solid mass of the grass. The main ditch and laterals can later be marked out and opened up with a plow.

Rhodes grass may easily be transplanted in a similar manner

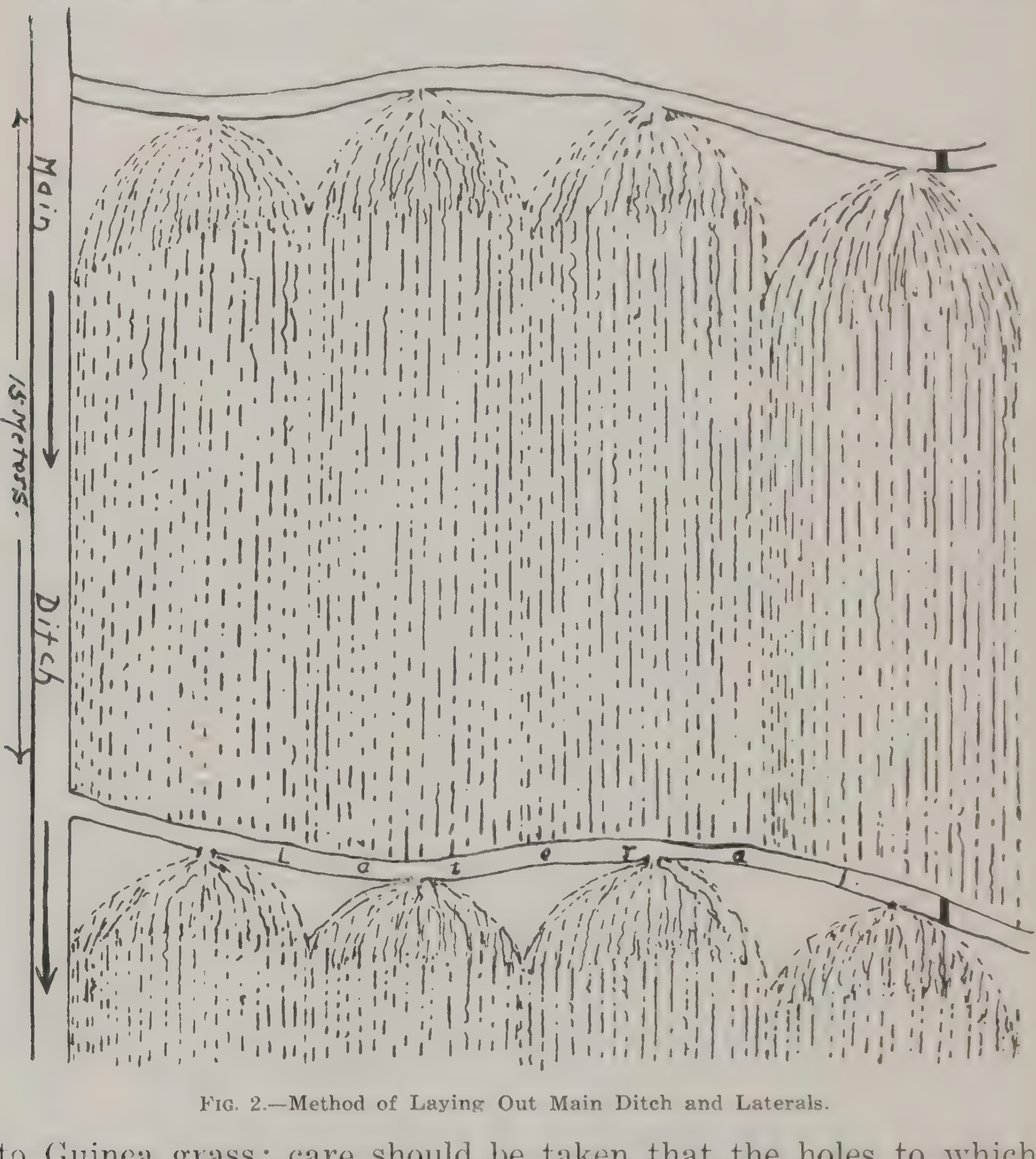

FIG. 2.—Method of Laying Out Main Ditch and Laterals.

to Guinea grass; care should be taken that the holes to which it is transferred are both wide and deep. The ordinary method of making these holes with a pointed stake is most unsatisfactory, as the ground is compressed and hard, and gives the young roots no chance to spread. A mattock should be used, and one stroke should be sufficient to make a hole deep enough for all purposes, while leaving the soil loose. The grass should be

watered at the time of planting and every three days afterwards until it seems to be growing well.

Broadcasting in old disused paddies has been attempted, with most satisfactory results so far, though whether the grass will withstand the constant flooding which is bound to occur during the wet season has yet to be determined.

Irrigation.—Rhodes grass probably demands more water when first planted than Guinea grass, but once started it may safely be said to require much less.

When first planted, if from seed, the ground should be thoroughly soaked, after which the seed is sown; it can not again be irrigated until the seed has germinated and taken a fair hold in the soil. The first few irrigations after germination should be carried out with great care or else many of the small seedlings will be washed away and destroyed. Generally speaking Rhodes grass seedlings should be irrigated every three to five days for the first month, after which every fifteen days is sufficient.

When the plants are transplanted, the clumps of grass are carefully separated out and set in water until needed. They should be irrigated at the time of planting and every three days subsequently until well established, after which once every fifteen to twenty days is sufficient, depending on the season.

Rhodes grass stands the wet season well on fairly well-drained land.

Harvesting.—From the time of planting Rhodes grass takes approximately three months to reach its full growth; two months should elapse between subsequent cuttings. If cut during the first part of January it may again be cut in March and finally in May, thus allowing three cuttings during the dry season in central Luzon.

The proper time for harvesting can only be determined by experience. It may be assumed that as soon as the grass heads out it has reached its maximum growth and is ready to be cut. It however does not present the light appearance seen in timothy when it has reached the harvesting time.

The curing of Rhodes grass for hay requires great care and attention. If it is not sufficiently cured it quickly heats and becomes *moldy;* on the other hand, if exposed to the action of the sun for too long a period, the grass shrivels up and becomes dry and fibrous and unfit for hay. Besides this, it bleaches to a very light straw color, which no doubt would greatly lessen its commercial value.

In regard to the various methods of cutting, it may be said that when the field is planted in belts or bands, the ordinary hay mower can profitably be used; on the other hand, where it is planted in rows, the ground is so uneven that the use of machines is impracticable and so cutting by hand must be resorted to—a rather expensive method. If, however, the intermediate rows have been filled in and care has been taken to level them during transplanting there is no reason why the machine should not be used.

Rhodes grass cut during the day is stacked in small cocks at night. (See Plate I.) Next morning these are again spread out in the sun, care being taken that the grass is well shaken out. It is well to note here that the "manojos," or handsfull, made by the cutters have a tendency to adher too closely and do not cure unless opened up. After the grass has cured all day and has been turned once or twice to assure a uniform exposure, it is placed in large cocks for the night. If in the judgment of the haymaker it is now cured, it may be hauled to the barn or it may be exposed to the sun for another half day; more curing than this has in our experience been deleterious in its effects as the hay then begins to bleach. (See Plate II.)

The hay should be carefully watched for a while in the barn to prevent heating. If it is to be baled it is well to turn it all out and shake it up in the sun for half a day before finally putting it through the machine. In this way one can be assured that there are no damp spots, and any slightly moldy spots which may possibly have formed can be done away with.

The yield of Rhodes grass per acre is exceptionally good. Three cuttings from a patch slightly more than 1 hectare in extent gave 7,975 kilos—and this in a year when all crops were below average on account of the long continued drought.

Baling.—For the purpose of baling a steampower baler was used. This works at the rate of about fourteen bales (a little less than a ton) per hour; seventeen of these bales average about a ton. Unless the hay is intended for the market this process is not necessary. The chief advantages are that the hay is more easily handled and that there is less waste, especially where the animals to be fed are in different stables at some distance apart. Also it is probable that in this form less moisture will be absorbed during the wet season.

Cost of producing 6 tons of Rhodes-grass hay.

Plowing, planting and cultivating 1 hectare up to first cutting		₱100.00
Irrigation, 4 men at ₱0.70, for eighteen days (irrigating six times in one season)		50.40
Harvesting, 1 capataz at ₱1.60, and 10 men at ₱0.70, for six days		51.60
Hauling, 1 man at ₱0.80, 1 team at ₱1, 3 helpers at ₱0.70, for three days		11.70
Baling:		
1 capataz	₱1.60	
1 man feeding machine	0.70	
2 men tying wires	1.40	
3 helpers	2.10	
2 men cutting wires and stacking	1.40	
1 engineer	1.00	
1 fireman	0.70	
400 pounds coal	2.20	
Wire, oil, waste	4.00	
	15.10	
For three days		45.30
Pumping charges		50.15
Total expenses		309.15
Receipts: 6 tons hay at ₱89		534.00
Total expenses		309.15
Profit from 1 hectare (6 tons)		224.85
Profit per ton		37.47

AGRICULTURAL EXTENSION WORK.[1]

Compiled by SAM. H. SHERARD, B. Sc.,
Agricultural Inspector.

INTRODUCTION.

Special interest is now felt throughout the world in agricultural extension work. State and national legislators, the managers of the great transportation companies, the officers of boards of trade, residents in towns and cities, as well as educators and educational institutions, particularly the agricultural colleges and experiment stations, and state and national departments of agriculture, all have suddenly come to realize the immediate and paramount importance of the practice of a better agriculture by the great body of farming people. Just now attention is turned as never before toward the discovery of effective and economic methods for accomplishing this end.

DEFINITION OF EXTENSION WORK.

The committee on extension work, in a meeting at Baton Rouge, Louisiana, in November, 1906, gave the following definition to extension teaching:

> Extension teaching in agriculture embraces those forms of instruction, in subjects having to do with improved methods of agricultural production and with the general welfare of the rural population, that are offered to people not enrolled as resident pupils in educational institutions.
>
> Agricultural extension work also embraces anything that will improve conditions on the farm or aid in improving the rural population. Extension work connects the farmer with the agricultural colleges and experiment stations and gives to him new things of economic importance that have been tried out and found to be practical on the farms of progressive planters. Through extension work, farmers in thinly populated neighborhoods are brought closer together and learn of the doings of farmers in other local-

[1] From notes taken from the Annual Report of the Office of Experiment Stations for 1910, and from the Report of the Committee on Extension Work, Circular No. 72, of the Office of Experiment Stations, United States Department of Agriculture.

ities. It is a new movement brought about by the wasteful methods of our present agriculture, and it is destined to be of untold value in future national progress.

During the present session of the United States Congress, Hon. A. F. Lever, of South Carolina, will present a bill providing for extension teaching in the United States. The Lever bill provides for Federal appropriations beginning with ₱1,000,000 for the first year and increasing at the rate of ₱600,000 per year until a maximum of 6 millions has been reached. In order to avail themselves of these sums the States must raise an equal amount.

The bill provides for giving every State ₱12,000 per year before any further division has been made, and the surplus above this amount to be prorated among the States on the basis that the rural population of a given State bears to the total rural population of all the States. This money goes to the agricultural colleges and is to be used for the express purpose of establishing and maintaining an extension department and in sending out a trained man who understands the best method of agriculture into every community to interpret and demonstrate the best system of agriculture, and to extend this work from year to year, as the appropriations increase and the men become available, until such a man is permanently located in every agricultural county.

When every agricultural county in the land is supplied with a capable man, which can easily be done within from seven to ten years, the total expense for both State and Federal appropriations will be between 14 and 16 centavos per capita. If this plan increases the farm output 50 per cent, after it is thoroughly introduced, it will increase the value of the output of the farms by at least ₱100 per capita.

The Lever bill is the logical sequence of the Morrill Act, the Hatch Act, and other legislation which has created the colleges of agriculture and the experiment stations. These institutions, together with the Federal Department of Agriculture, have been at work for many years and have gathered a vast fund of useful knowledge relating to scientific farming, and building up and maintaining the fertility of the soil. So far, however, this knowledge has not to any appreciable extent come into general practice by the farmers. All agree that the next step in agriculture is extension work, carrying this information into every farming community by means of trained demonstrators.

That which has come upon the United States with such suddenness was felt by older nations years ago and efforts were then

begun to provide for the future food requirements of their growing populations before these populations would have overtaken production and their people be face to face with insufficient means for self-support. In endeavoring to solve the problems that land impoverishment had brought upon them various experiments were tried by different countries with varying degrees of success.

An examination of the present condition of agriculture in European countries, compared with that when attention to better farming first began, shows that there has been great advance and that the limit of production has not yet been reached. The results that have been accomplished in one of the smallest countries of Europe (Belgium), and the methods that were employed in effecting her remarkable advance, have been set forth in detail in a recent publication by the minister of agriculture of that country giving the methods employed in each province, and the rise in price of agricultural lands, and increase in their productive power during the last twenty-five years.

This report is of special interest just now because extension work has been carried on in Belgium long enough and thoroughly enough to show how it affects agricultural conditions and benefits agricultural people. A translation and an abstract of this report have been made by the assistant farmers' institute specialist of the Office of Experiment Stations, United States Department of Agriculture, and is herewith presented in the belief that the experiment in Belgium is well worth consideration by all who are interested in the extension movement in the Philippine Islands.

EXTENSION WORK IN BELGIUM.

Belgium is only 29,456.07 square kilometers in area, and had a population in 1900 of 6,693,548 souls, nearly equal to that of the Philippine Islands. About one-fifth of the people are engaged in agriculture. Their holdings are mostly small, varying from about 0.4047 hectare to 40.47 hectares and over. The agriculture of the country was in a much neglected condition prior to 1885, at which time a method of improvement was adopted that has produced remarkable results. Under this system the average for wheat in Belgium has been raised from 21.333 hectoliters per hectare in 1885 to 33.467 hectoliters in 1910; the average for rye was increased from 20.776 hectoliters in 1885 to 31.860 hectoliters in 1910; oats from 43.455 hectoliters in 1885 to 70.949 hectoliters in 1910; barley from 33.306 hectoliters in 1885 to 50.129 hectoliters in 1910. The number of

horned cattle increased from 1,382,815 in 1880 to 1,817,587 in 1907; hogs from 646,375 to 1,379,462.

The price of farm lands in the same period rose from ₱420 per hectare in the Province of Anners to ₱648, etc. In this same period the home surroundings of the farmers were also greatly improved, the quality of the live stock was much bettered, and a great industry has arisen in market-garden products and in floriculture.

The remarkable improvement in the agriculture of this country is attributable, as has been intimated, to the measures adopted in 1885, whereby the office of extension supervisors was created by the Crown, and the oversight of agriculture in the various provinces was placed under the control of these supervisors. The specific duties and method of operation are explained in the discussion that follows, and are suggestive of methods that might be put into operation in improving agriculture in the Philippine Islands.

Extension supervisors.—The office of extension supervisors was created by royal edict September 26, 1885. The supervisors have for their principal mission the popularization in a practical manner of the knowledge and processes of agricultural science. They put themselves in direct contact with cultivators and give them gratuitously the counsel desired. They perform functions of nomadic (peripatetic or itinerant) agricultural lecturers in their territory and organize annual conferences in at least five districts throughout each section, in order to hold a complete course on some one or other branch of the science or the practice of agriculture applicable to the region. The supervisors are further charged with organizing demonstration or experiment fields in order to give practical instruction to the farmers.

The fields of operation of the extension supervisors were distributed according to agricultural regions, the entire country being divided into six such divisions, three of them being covered by two supervisors each and the other three having one supervisor each.

The chief extension supervisors were appointed by royal edict September 26, 1885, and after installation by the minister of agriculture they entered upon their duties on October 15, 1885.

Under the direction of M. Carluyvels, inspector-general of agriculture, and M. Proost, director-general of the rural office, the new service was not long in attaining the highest results.

In 1894, experience having demonstrated that it would be advisable to make the fields of operation of the extension super-

visors correspond to the administrative division of the country, a ministerial decree was issued providing that each of the governmental provinces should be served by an official agriculturist with one or more deputies, the deputy agriculturist to be specially charged with serving, under the direction and responsibility of the provincial agriculturist, a group of agricultural assemblies (civil divisions). The deputy assistant agriculturists fulfill, then, the same functions as the provincial agriculturists. In 1897 the administration decided to place them on an equality with the provincial agriculturists as regards their title and their relation with the central administration and with the public. The royal edict of October 25, 1897, countersigned by the minister of agriculture, provides that the corps of extension supervisors comprise twenty agriculturists. This distribution of the fields of operation of the service according to the administrative divisions is preserved.

A royal edict of December 24, 1898, coördinates all of these edicts and modifies the arrangement in effect at that time concerning the services of the agriculturists. This edict fixes the salaries of the supervisors and provides that in order to be nominated to the office one must have the diploma of agricultural engineer. Exception to this rule may be made with those who have conspicuously proven their knowledge of agriculture and successfully passed an examination before a special jury. There are now thirty-four extension supervisors in Belgium, besides numerous assistants.

The edict of December 24, 1898, defines the purpose of the supervisors as follows:

(1) To popularize the information and operations of agricultural science, especially by means of oral consultations, conferences, demonstration or experiment fields, etc. They are to place themselves in direct relation with the cultivators and give them, free of charge, the counsel they desire. They are to fulfill the functions of a technical adviser and agricultural lecturer.

(2) To inform the cultivators of the advantages which they are able to procure through associations, and to furnish precise data regarding such organizations and the functions of the different agricultural groups.

(3) To enlighten the central administration regarding the work of the official agricultural societies or auxiliaries and their financial encouragement due to the subsidies which they receive and also regarding the honorary distinctions which are to be granted.

(4) To organize and to direct the agricultural courses for adults, courses in horticulture, arboriculture, vegetable gardening, etc.

The organic edict provides for one or more temporary assistants to each supervisor, their duties being to give the agricultural courses and to organize the demonstrations established at the expense of the State. Besides organizing agricultural associations and giving regular complete courses of instruction on a particular subject, the extension supervisors give numerous isolated conferences and talks on subjects of general interest. In 1886 these agents gave a total of 400 agricultural conferences.

The minister of agriculture issued a decree dated September 28, 1885, requiring at government expense the organization of experiment fields under the direction of the supervisors. These practical tests or experiments and scientific demonstrations must include the composition and fertility of the soil, the adaptation or acclimatization of desirable plants, and the employment of improved machinery. The experiments likewise include, according to the region, tests of garden vegetables, horticulture, forestry, apiculture, the care of poultry and of milk, the raising and fattening of live stock, etc.

The number of experiment fields under the control of the supervisors is considerable. In the beginning they were utilized to test fertilizers and new varieties of plants and were largely demonstrative in character. The use of these experiment fields is to-day largely extended, and for the past ten years they have been used more for the acquisition of new knowledge than for the popularization of known facts. Since 1903 uniform and systematic experiments have been organized for each region of the country in order to obtain practical information regarding the fertilizers needed and the influence of thorough cultivation. Experiments on the feeding of dairy cows and the fattening of cattle and hogs have likewise been systematically organized since 1901. When occasion has arisen experiments have also been carried on regarding the diseases of plants. Forecasting the weather has also been conducted for several years by this organization.

The supervisors assist and encourage by giving advice and counsel in the organization of agricultural societies, but do not take part in their creation. In their administrative relation the supervisors are called upon to give advice on all questions relating to agriculture in their territory, such as agricultural statistics, organization and control of agricultural extension instruction, orders of merit, subsidies to agricultural societies, etc.

FORMS OF EXTENSION WORK IN THE UNITED STATES.

Group A, farmers' institutes.—The farmers' institutes are a phase of the itinerant lecture system classified under Group B, but they form so large and distinctive a movement that it seemed wise to put them in a class by themselves. Historically they are the earliest form of organized extension teaching. They have been for thirty-five years the means of disseminating real agricultural teaching. They are supported by large grants of money, are now pretty thoroughly organized, and the institute workers have an association of their own. For these reasons they demand a separate classification.

Group B, itinerant lectures other than farmers' institutes.—Here are listed the lectures and addresses given by members of the agricultural college and station staff and by employees of other institutions, including miscellaneous lectures, regular courses of extension lectures, traveling schools of various types, special railroad trains designed for education purposes, and addresses before teachers' institutes on distinctively agricultural themes. Various minor endeavors, must, of course, also be grouped here.

Group C, literature.—This group comprises those forms of extension teaching developed by means of written and printed material. This literature consists of the great mass of regular correspondence about agricultural subjects carried on through the experiment stations, colleges, boards of agriculture, etc.; also the various publications of these institutions, including station bulletins, regular reports, miscellaneous pamphlets, and the like; correspondence courses, reading courses, traveling libraries, and the publication, particularly by educational institutions, of periodicals dealing with agricultural subjects.

Group D.—This comprises all those efforts in which the particular emphasis is laid on object lessons, or outdoor practicums. This includes such activities as field demonstrations of various operations, such as spraying; coöperative demonstrations in which, because of the nature of the work, it is necessary to have the assistance of the individual farmer, and coöperative tests, as of varieties adapted to different localities. These tests, by the way, are close to the border line between the work of the experiment station and of the extension department, but are classified here because in many cases they are essentially for the purpose of education and not for the gaining of new knowledge.

Education exhibits at agricultural fairs, made by colleges, experiment stations, etc., and attempts to secure visits of inspection to the colleges and stations by farmers and others interested, where these visits are essentially for the purpose of education, also come in this group.

The above four groups, A, B, C, and D, are intended to include all of those forms of extension teaching in agriculture which belong to universities, colleges, and other departments, agencies, or institutions whose work is distinctively and primarily educational.

Group E, on the other hand, was meant to include those aspects of the work of the multitudinous rural societies, as carried out in their meetings and propaganda, which aim to instruct. These may comprise the efforts of agricultural fairs to introduce educational features; programs of the various horticultural, livestock, and other agricultural societies; lecturer's hour in the grange; village improvement societies; civic associations with rural betterment sections; rural study clubs; boys' and girls' agricultural clubs or institutes, such as the Junior Naturalists in New York, the Nature Guard in Rhode Island, etc.; and agricultural students' unions of various types. Rural societies, in carrying out these lines of endeavor, are quite dependent upon the colleges and stations for their material, and oftentimes for the initiative. Nevertheless, the classification is logical, because eventually the work must be fostered and developed by the capacity and persistence of the voluntary organizations themselves.

Group F.—It was meant here to outline a field which is somewhat indefinite in character, but one in which the colleges have a part, together with other agencies. It comprises that form of endeavor which attempts to secure coöperation among various rural organizations and institutions, such as efforts to secure joint sessions between other associations, the organization of associations of teachers and school patrons, the formation of leagues or federations of rural societies for rural progress, the installation of a town room as a sort of social center for the town, etc.

It will be observed further that this entire classification is based, primarily, upon varieties of work to be done, and secondarily, upon types of institutions doing the work. It is an attempt to lay out a logical division of the field of extension teaching.

FORMS OF EXTENSION WORK ACTUALLY CARRIED ON BY AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS IN THE UNITED STATES.

Lecturing at farmers' institutes.
Holding normal institute schools for institute lecturers.
Providing short courses in agriculture.
Equipping and accompanying railway specials.
Assisting at teachers' institutes.
Courses in corn and stock judging given in district centers.
Lectures in district normal schools.
Visiting and lecturing in rural schools.
Holding summer schools for teachers.
Sending out field specialists to give advice to farmers.
Preparing courses of study for agricultural high schools.
Traveling instructors to lecture before granges, farm clubs, etc.
Equipping and sending out traveling "vans."
Correspondence (ordinary).
Preparing and sending out bulletins, reports, and circulars.
Conducting reading courses.
Conducting correspondence courses.
Preparing articles for the public press.
Sending out model agricultural traveling libraries.
Conducting and publishing agricultural journals.
Preparing extension lectures in agriculture for rural schools.
Conducting agricultural correspondence courses for teachers.
Organizing and conducting school-garden work.
Organizing and conducting field demonstrations.
Holding field meetings for instruction.
Conducting coöperative experiments in agriculture.
Providing educational exhibits at fairs.

Organizing excursions to the college by the agricultural associations and by individual farmers.

Organizing excursions to the college by associations for teachers.

Conducting field experiments and tests in coöperation with the railroads.

Conducting experiments and field demonstrations in coöperation with National Department of Agriculture.

Conducting experiments and demonstration tests on country poor-farms.

Lecturing in grange halls.
Lecturing before women's clubs.

Organizing farmers' clubs, women's clubs, and boys' and girls' clubs.

Organizing agricultural students' unions.

Sending agriculturists to judge stock, fruit, etc., at fairs.

Organizing nature-study work in the public schools.

Organizing societies of farmers in each county.

Organizing agricultural high schools.

Creating departments of extension work in the college.

Making a study of social and economic questions of agriculture.

AGRICULTURE IN THE CATANDUANES ISLANDS.

By E. H. Koert, *Agricultural Inspector.*

The Catanduanes Islands constitute a group of a dozen or more islands and islets off the coast of Albay Province and form a subprovince of the latter. The principal islands are Catanduanes proper, Panay, Palunpum, Late, and Baguio; the rest are of little importance.

In general the agricultural methods in use here are very primitive. The people are very anxious for improvement but must be shown the advantages to be obtained by modern methods before they are convinced and ready to adopt the new and discard the old.

The exports are hemp and copra; crops for home consumption are palay, corn, camotes, mongos and beans. A large number of plants are also cultivated for use in the preparation of "gulay."

HEMP.

Hemp is generally the third crop that the Catandugñan puts in on a new piece of ground. After the selection of a site locally called "late" his first work is the clearing away of the underbrush and scrub; this effected, the big trees are felled and when thoroughly dry the whole is burned. After burning, the residue is cleared off and if an opportune rainfall happens to occur and the farmer finds himself in possession of seed, mountain rice is planted. This is accomplished by scratching the ground with a stick and dropping the seed into the holes. A slight rain before the rice has sprouted means the loss of the seed on these steep mountain sides. If the rice is successfully harvested camotes are planted as a second crop. During the time that the camotes are growing the hemp is set out, the camotes being gradually replaced by a creeper grass called "smokin;" this has a very luxuriant growth and would bear investigation but is very

little relished by horses and cattle. In course of time if neglected the hemp will be stunted to such an extent by the "smokin" that harvesting does not pay; at this stage the plot is abandoned and a new site selected.

It is a safe estimate to say that not over 30 per cent of the hemp is harvested. The absence of trails and roads is the principal cause, and also the few necessities of the people which can be satisfied only with money.

Hemp production could be greatly increased if the municipal and subprovincial officials were more active and instructed the people so they would appreciate the fact that it would pay them to have the finished product always on hand to take advantage of any temporary rise in price. At the present time it is principally the Chinaman who benefits from any increase in price, as he stores his hemp and waits for a favorable market.

The exports of hemp from the Catanduanes Islands amount to about five or six thousand bales[1] a month. This is aside from the production of the district around Calolbon, which is almost all taken to Tabaco in small native sail boats; the reason for this is the great advantage in price prevailing in Albay Province.

COPRA.

This is a new product in these islands. Even to-day some districts produce little or none but the amount is increasing monthly, and the plantings have been so heavy that in the course of a year or two the output will increase from 200 to 300 per cent. There is a heavy home consumption of coconuts here, the most of which are used in the preparation of the various forms of "gulay."

A very inferior method of planting is in vogue here; the ground having been partially cleared the sprouted nut is laid into a slight excavation made with a bolo, then covered up, and abandoned; when the tree begins to come into bearing a slight attempt is made at clearing, often resulting in the destruction of a large number of trees through the accidental firing of the brush which has been left promiscuously scattered around. A gradual improvement can be seen here and there and it is now possible to find an occasional grove fairly well kept. More intercourse with the people of more advanced provinces would be of material benefit.

[1] 1 bale = 126.5 kilos.

RICE.

This staple is not raised in sufficient quantities to supply the small home demand. Lack of knowledge in utilizing the abundance of water and the crude methods of cultivation are to blame for this state of affairs. More than fifteen varieties of rice can be found on the island. A large amount of upland rice is grown. A very dark variety is highly liked by the people and locally known as "paroy itum."

The importation of new seed is of prime necessity as the local rice is so heavily intermixed with the different varieties that an even harvest is impossible.

The greater portion of the imported rice is consumed in the larger centers of population; after the home crop is consumed the barrio people depend primarily on camotes and the various forms of "gulay."

CORN.

Corn or maize is grown to a considerable extent to take the place of rice. It is usually planted after the rice harvest. The land is plowed and harrowed and the corn planted with a small stick and then left without any attempt at cultivation. It is hard to convince the people that they would get a better crop with proper cultivation and more distance between rows and hills, their belief being that the larger number of stalks will produce a larger amount of corn.

The corn is usually prepared for consumption by roasting the ears; a small amount is used in preparing a tasty desert from the flour made by pounding the grains.

INTRODUCED VEGETABLES.

A few words ought to be said with regard to the gratifying results obtained within a short time through coöperation with the schools. A year ago there was not a single home garden in existence; what few native vegetables were raised came from the barrios, being mostly of wild growth. The writer has distributed a large amount of seeds, this distribution being generally made by planting a seedbed in a barrio and making it the property of the entire population; later on with the commencement of school terms the seeds were turned over to the barrio teachers with the understanding that they were to be given to all people who should have ground prepared and adapted to the planting of vegetables. The result has been that American plants can be found in the most remote barrio.

Giving seeds to the people promiscuously in the larger towns was found to be merely a waste of seed as the large number of chickens and animals would generally destroy everything in sight.

The district around Pandan appears to be well adapted to the raising of cabbage, exceptionally fine results having been obtained there. All heads are solid and of good form, though not very large.

A very regrettable circumstance is the lack of appreciation of the people of their own native fruits. The papaya for example is hardly ever eaten. Of the banana there are a number of fine varieties but no cultivation is attempted. After a destructive baguio, it takes months and months before a banana can be purchased. Several varieties of fruits are now being propagated at the Bicol Farm and by the time these come into bearing a proper appreciation of fruit as a food may be realized if the schools introduce domestic science locally and educate the people up to it.

BUREAU STATIONS REPORTS FOR MAY.

LAMAO EXPERIMENT STATION, BATAAN.

A continuance of the various projects, as outlined in last month's report, was carried on during May. Budwood of the following varieties of citrus fruits was received at the station May 6.

Citrus nobilis × *Citrus decumana,*	Sampson tangelo.
Citrus decumana	"March."
Citrus decumana	"Triumph."
Citrus limonum	"Valencia."
Citrus aurantium	"Pineapple."
Citrus aurantium	"Washington navel."
Citrus aurantium	"Jaffa."
Citrus aurantium	"Ruby."
Citrus limonum	"Clarke."

Budwood of two lots of the biriba (*Rollinia orthopetala*) was also received and budded.

All these varieties are making satisfactory progress.

On May 10, two thousand pineapple slips of the Cayenne variety were received from Hawaii. They were planted in beds 3 meters wide, six rows to each bed, and the slips set 60 centimeters apart in the rows. Paths 180 centimeters wide were made between the beds, thus making it easy to cultivate the plants during growth, and also to harvest the fruit when mature. This system of planting pineapples is employed quite extensively in Florida. It is believed that the introduction of the Cayenne variety and others on the way will mark a new epoch in Philippine pineapple culture.

May 23, Mr. H. H. Boyle, assistant horticulturist of the Bureau, brought budwood of a superior avocado received by the Bureau from California. This is the second lot of avocado budwood successfully introduced into the Philippines by the Bureau of Agriculture. A section of the station will be devoted exclusively to the avocado in the future.

The testing of legumes, begun last year, is being continued this year and about one hundred varieties are being planted in plots, ranging from 100 to 1,000 square meters each. The object is to determine the relative value of each as a cover crop, forage crop, green manure, or the value of the pods and seed used as a vegetable. One planting of the legumes is now being made, and later, about August, a second planting will be made.

During the month the anonas and avocados have been very seriously attacked by mealy bugs (*Pseudococcus* sp.), and the red spider has caused some damage to the citrus trees. Kerosene emulsion and resin wash have been used effectively in their control. The resin wash appears to be particularly valuable in the extermination of the mealy bug. (*F. C. Kingman, acting superintendent.*)

LA CARLOTA EXPERIMENT STATION, OCCIDENTAL NEGROS.

Since our last report 198 millimeters of rain have fallen at this station, the major part coming during the latter half of the month. Until the middle of the month less than 25 millimeters fell.

Approximately 8 hectares of land have been given a second plowing.

Our 5 hectares of experimental plats, 4.5 hectares of corn, and 2 hectares of Guinea grass, have been cultivated and hoed.

Five small plats of sorghum were harvested. These produced very fine heads of grain, but the balance of the plants would have been useless for fodder owing to plant lice.

During the month we have planted eleven varieties of abacá which Mr. Saleeby brought from Leyte, 0.4047 hectare of soy beans, a few plats of mongos and chickpeas, 4.5 hectares of corn, 0.04047 hectare of Sudan grass and some garden vegetables.

Eight varieties of Mindanao abacá were transplanted from boxes to the nursery.

To our herd of horses have been added four mestizo colts, two males and two females. The males were sired by native stallion L-53 and the females by native stallion L-29. They are all doing nicely.

Our Indian mestizo cattle have been increased during the month by two calves, sired by L-31.

One calf has been added to the carabaos.

No increase has been noted among the goats.

We have lost one Berkshire sow.

The work of eradicating lantana has been discontinued until later in the year when we hope to be able to uproot the last bush on the farm.

Many of the gawai-gawai fence posts which we placed late last year failed to grow owing to the unusually dry season which followed. Replacing these posts will occupy a good portion of our time during the coming month. (*H. J. Gallagher, superintendent.*)

THE BICOL FARM, VIRAC, CATANDUANES.

With respect to breeding, May will probably be the second best month for the season. The combined total of the number of mares bred at the Bicol Farm and at the station at Bagamanoc to date is in the neighborhood of three hundred. The estimated total for the two stations for the year is three hundred and fifty at the Bicol Farm, and two hundred at Bagamanoc; this is exceptionally good for the latter place as there are only some three hundred and fifty mares available, and this is the first year of breeding at this place. On account of an outbreak of disease in the jurisdiction of Pandan no animals from there are permitted to be brought into the jurisdiction of Viga.

A report of an outbreak of rinderpest in Viga reached the writer on the 8th of the month, and upon receipt of the proper instructions, an investigation was made of the cattle and carabaos in the entire municipality of Viga and all were found in excellent condition. The report was caused by the death of two calves from diarrhea, and three head that had died by violence, and the caretakers tried to protect themselves by misinforming the owners.

On this trip was seen for the first time the large extent of pasture available on the east coast of the main Island of Catanduanes and on the smaller Island of Panay.

During the month a large number of castrations were performed by the undersigned and several were also effected in the north. The municipality of Calolbon is working hard to effect through moral persuasion the castration of all inferior animals. If this can be kept up the native stallion will be practically eliminated from the breeding question.

The drought is beginning to seriously affect the upland pasture. At the Bicol Farm all planting has had to be discontinued on this account. The only plants able to withstand it are corn, Guinea grass, and *Phaseolus aconitifolius;* the latter does exceptionally well where there is a good deal of limestone.

The municipal council of Calolbon has recently adopted a resolution providing for a trimonthly meeting of councilmen, tenientes of barrios and citizens in general for the purpose of having lectures on hygiene and agriculture and horticulture, the municipality to pay all expenses of the district health officer and the undersigned, who have both been requested to attend and take charge of what pertains to their respective lines of work. (*E. H. Koert, in charge.*)

CURRENT NOTES[1]—AUGUST.

A NEW BRANCH OF THE CITRUS INDUSTRY.

One of the common and cheap bases of perfumes is oil of petitgrain; this is made by distilling the leaves of the wild, or bitter, orange. At present a large part of the world's supply of petitgrain comes from Paraguay, where the wild orange trees are so abundant and vigorous that the leaves can be gathered in vast quantities at all seasons of the year.

Although it requires some 200 or more kilos of the leaves to produce 1 liter of the pure oil, the value of this is so high, and the cost of the labor so cheap (about ₱0.50 to produce 10 kilos of the raw material) that a considerable profit is realized.

We are beginning to believe that the Philippine Archipelago is the home of several, if not actually all species of Citrus, and we challenge the world to show any more vigorous and healthy specimens of that genus than can be found here in these Islands. Of course, like most other crops, the Filipino planter gives the orange little or no real cultivation, but if a fair share of the waste ground in the Philippines were planted with suitable varieties of citrus, we believe Paraguay would have to look to her laurels in the matter of orange-leaf-oil production.

In this connection, we understand that very interesting experiments have already been made here with the object of determining the practicability of extracting oil from the peel of the naranjita and other Philippine citrus fruits, thus permitting the utilization of all unmarketable fruits—a by no means unimportant matter in several districts of Batangas, where it appears that immense quantities of the fruit are from time to time wasted. (*O. W. Barrett.*)

HYBRID ANONAS.

In 1907 and 1908, the writer, then connected with the subtropical garden, Miami, Florida, of the United States Department of Agriculture, in the course of his tropical-fruit investigations

[1] Original notes prepared by various members of the Bureau of Agriculture.

discovered the proterogynous and entomophilous character of the cherimoya (*Anona cherimolia* Miller), the sugarapple (*Anona squamosa* L.), the custardapple (*Anona reticulata* L.) the soursop *Anona muricata* L.), and the mamon (*Anona glabra* L.). Simultaneously experimental hybridization work with these species was also begun and the cherimoya and sugarapple, the cherimoya and mamon, the mamon and sugarapple, and the sugarapple and custardapple were successfully hybridized.[1]

All these species except the cherimoya are well adapted to all parts of the Tropics. The cherimoya would seem to be subtropical rather than tropical, for while the semitropics in both hemispheres, in Florida and California, France, Spain and Italy and Queensland, Australia, it fruits near the sea level, it is a notable fact that it fails to do so in the Tropics except in the highlands, and this perhaps explains the fact that the Spaniards failed to introduce the cherimoya in the Philippines, where the Spanish civilization was confined largely to the lowlands of the Archipelago.

It seems a pity that the cherimoya, the most esteemed of all the Anonas, should be thus barred to the real Tropics. However, if the low elevations are not adapted to the cherimoya we may in the future find a good substitute in the new hybrids. The writer brought seeds obtained by crossing the cherimoya and sugarapple from Florida to the Philippines in March, 1911, and the seedling hybrids, grown within 2 meters of the tidewater in Manila, have in one year made a growth of about 2.3 meters and are remarkably vigorous and thrifty. The male parent is in this case dominant in all the hybrids—about thirty—to an extraordinary degree with respect to their foliage characters, in fact anyone not familiar with the history of the plants would without hesitation pronounce them to be cherimoyas. The fruiting of these hybrids will be awaited with much interest. (*P. J. Wester.*)

AGRICULTURE IN AFRICA.

Although one of the last countries in the dark continent to become interested in agronomy and stock raising, Benadier has finally awakened and bids fair to become a rather promising region. Notwithstanding the very light rainfall which prevails throughout the coast areas of Eastern Central Africa, Benadier possesses several very rich valleys, and by constructing dams

[1] Wester, P. J., Pollination experiments with Anonas, Torrey Bot. Club. 37: 529–539, 1910.

more or less irrigation can be carried out through the long, dry season. The native Somalis prefer cattle raising rather than any line of crop work. This preference originated in pre-Italian times when pillaging and intertribal warfare was the order of the day, as sheep and cattle could be moved at short notice to safe retreats, while the maize, kafir corn, cotton, etc., would needs be left behind to fall into the hands of the enemy.

Because of the great extent of pasturage in the valleys and the low rate for native labor, the cattle industry bids fair to be very lucrative. Camels, asses, goats, and sheep are also raised very cheaply in Somali Land.

On the other side of the continent, German Southwest Africa is recently making great strides in sheep raising. Two very distinct types of sheep are in evidence there: the "Bocky" which is known throughout South Africa as a very fine mutton sheep, and the Australian wool breeds. The old "Bocky" is probably descended from the fat-tailed sheep of Zanzibar; a few individuals of the latter breed have just been introduced into the Philippines, and are said to be doing well in Masbate. This being a distinctly tropical breed of sheep, the animals do not suffer as much from the heat nor is there so much danger from fly maggots as in the case of the merino, or long-wool, breeds which have not succeeded well here thus far. In the southern portion of the colony cattle breeding is becoming decidedly profitable. (*O. W. Barrett.*)

INTENSIVE FARMING.

Comparisons are said to be odious, but if the average Philippine farmer could be made to realize the possibilities of intensive farming, this country would undoubtedly soon enter upon a new era, and would avoid some of the adverse criticisms that are sometimes made upon its progressiveness along the lines of agronomy and horticulture.

For instance, in the Canary Islands, Madeira, and the Azores, the farms, which by the way, are of only 1 to 2 hectares in size, are made to yield many times the crop material which the same area usually produces in this Archipelago. With the high degree of economy and thrift practiced by the inhabitants of those countries, the soil is kept at "high pressure," so to speak, and never given more than a few days' vacation during the year; one crop follows another immediately; no weeds are allowed to interfere, and the planter, realizing that he has to make himself independent of the climate, provides cheap but effective systems

of drainage and irrigation; and last, but not least, he provides cement-lined stone reservoirs to obviate all drought troubles. Another original, if not brilliant and very economical idea, is the common utilization of *fences for irrigation trenches;* that is, the necessary and numerous stone walls are provided with cement-lined grooves on top, and these grooves lead the water to the vicinity of the cultivated plat where it is turned off from the fence groove to the ground. This system, of course, avoids wasting precious space with ditches and canals, and also avoids the danger of such trenches being damaged by heavy rains.

In the Canaries, seven hundred bunches of Canary Island, or Chinese, bananas may be produced annually on 1 hectare of these thrifty farms; and the potatoes, tomatoes, pineapples, cherimoyas, etc. grown with such care—and incidentally profit—are famous throughout Europe for their excellent flavor, great size. and appearance of being *well bred*, so to speak. (*O. W. Barrett.*)

STILL ANOTHER NEW INDUSTRY.

The snakewood, or nux vomica tree, has been considered until very recently a strictly forest, or at least wild species, but the commercial status of the rare product having improved somewhat, attempts are now being made to bring this crop under domestication. At present most of the supply comes from southern India, though Cochin China possesses rather large areas in which the natives collect seeds desultorily, according to the demands of the market. The price of the seeds varies from about ₱0.05 per kilo for the first-class, well dried, and grades down to ₱0.03 per kilo, for the weak, light-colored "buttons." By the way, this seed, the source of all strychnine and nux vomica compounds in medicine, is one of the most beautiful, in my opinion, in the whole realm of botany. Its exterior is closely covered with silvery appressed hairs, which appear at first to be a glossy, velvety film; in fact, the seeds, after being washed from the plum-like fruit, and dried in the sun, resemble satin-covered dress buttons.

Should the present experiments in Dekkan succeed, there is no question but that this crop could be profitably grown on the hillsides of northern Luzon. (*O. W. Barrett.*)

LIMA BEANS IN CEBU.

Cebu, the most densely populated of any of the large islands of the Philippine group, is confronted at all times with the problem of producing on its farms an adequate supply of food.

Corn and rice, the principal food crops of the province, are largely grown throughout the island, but it is highly important that these crops be supplemented by others of known value. At the present time work is being carried on in Cebu by the Bureau of Agriculture, the Bureau of Education, and the Philippine Railway Company not only to improve the crops already grown, but also to introduce new crops. In a recent communication Mr. Carl F. Coppage, supervising teacher in the municipality of Argao, furnishes a brief statement of work done with Lima beans. The results obtained, as shown in this report which is published herewith, indicate that this crop is one worthy of more extensive trial in other parts of the Islands.

A small plot of Lima beans was planted about October 15, 1911, in a clay loam soil. The ground was spaded to a depth of about 10 inches, and beans planted in hills about 80 centimeters apart each way.

When the plants were well up they were thinned to two in each hill and bamboo poles placed to support the vines. After this they received no other cultivation than such as was needful to keep down the weeds. The past season has been the driest known here for years, and there has been scarcely any rain in Argao since January 1.

I have harvested these beans continuously since about January 15 and now (May 27) the vines are covered with blossoms and fruit in all stages of development.

No estimate could be made as to yield per acre or hectare that would be in any way accurate, but I have seen these beans grown in the United States and am convinced that the yield here is much better.

Another experiment was made in a sandy soil about 80 feet from tidewater. A few beans were planted near a stone wall about February 20, 1912. When they were a few inches high some bamboo poles were placed so that the vines could get to the top of the wall, and no other attention was paid to them. On my return to Argao I found these beans bearing fruit and doing fairly well, though not so well as the ones planted in October.

These experiments have been crude, and were made in the hope of getting some food crop that would do well on such worn-out soil as we find here in this municipality. They will be continued throughout the year in different localities and soils, and more accurate data kept.

No plant enemies, so far as I know, have attacked any of the plants.

If this variety of bean will be able to stand the wet season moderately well I am convinced that it will be a valuable addition to the food crops here in Cebu. (*H. T. Edwards.*)

NEW TEAS.

Long before coffee came into use as a beverage, and probably previous to the discovery of tea in China, the Arabs possessed a stimulating beverage called khat, or kafta, known to science as *Catha edulis*.

In many ways the khat plant is equal or superior to either

coffee or tea. It is a hardy shrub growing 2 to 4 meters high, and both the leaves and branches contain a stimulating principle analogous to caffein. Recently Europe has taken a new interest in khat, and there is a probability that a demand for this new old tea will rapidly increase. It is probable that not a single plant of this species exists in the Philippines, but if same *were* planted here, and if the public taste *should* demand this product, there would be no question as to the advisability of trying out the khat crop here.

At Singalong experiment station a very fine specimen of maté (*Ilex paraguayensis*) can be seen. This famous "tea" of Paraguay and southern Brazil is supposed to be very difficult of propagation and very few specimens of the species are found in the botanical gardens of the world. The maté shrub at Singalong is some six or eight years old and is growing so rapidly that it will soon be a tree fully as large as those of its native habitat. Some twenty million people are now using maté in preference to any other beverage, and a considerable quantity is exported from South America to Europe, although the article is practically unknown in the United States. Personally I prefer maté to any kind of genuine tea and believe it will eventually become a staple article of commerce throughout the world. If we could only create a demand for it here, with this proof of its wonderful adaptability to Philippine conditions, it is more than probable that first-class yields could be obtained. The Singalong specimen would now probably yield twenty times more of the raw product than a Japan or China tea plant. (*O. W. Barrett.*)

WHALES AND COCONUTS.

In certain lines of a few industries, whale-oil competes with coconut-oil. And while there are certainly great profits to be made in the manufacture of coconut-oil, it is doubtful if any business connected with animals or plants yields a greater profit, everything considered, than the whale industry. The writer has a case in mind of a company that was said to have paid 40 per cent dividends the first season, and that after the erection of the plant for trying out oil, drying and grinding the flesh, and utilizing the bones, besides the harpooning launches. In one station (Durban, Natal) it was an ordinary day's work to bring two or three 15-ton or 20-ton whales to the slaughter boards six days in every week.

An employee of this Bureau has seen as many as fourteen whales at once in the Sulu Sea. Why could there not be estab-

lished somewhere in the southern islands a floating factory similar to those being established in Brazil and on the Pacific Coast of the United States for handling sharks, whales, porpoises, and fish in those regions? In one of the Sulu Islands there is a lucrative industry at present which consists in catching sharks, removing their fins and merely drying, baling, and shipping this material for the justly famous Chinese shark-fin soup.

Thousands of the estates in the Visayas and Luzon need organic fertilizers, and whale-meat meal is now considered one of the best animal fertilizers known; shark-meat meal would be equally as good. The dried and ground flesh should be worth in Manila about ₱70 per ton. The bone meal is now worth ₱85 per ton here.

Japan, our neighbor on the north, is succeeding extremely well with her new whale industry; in fact, Japan has even beaten the Norwegian whalers at their own game, having perfected methods of catching and "dressing" these animals which are even more economical than the supposedly perfect methods in vogue in all other countries; it is now possible to buy canned whalemeat at an absurdly low figure, hence that nation is no longer obliged to depend largely upon fish for its animal food. Here in the Philippines, however, we have neither whaling stations nor rumors thereof, and worse still no list of the probably numerous kinds of whales found here, nor definite knowledge of their breeding and feeding habits, numbers, etc., which would be valuable to both the zoölogist and the money-hungry merchant or manufacturer. (*O. W. Barrett.*)

EGG POWDER.

The world needs vast quantities of egg powder. German China is producing it. Tsingtau is now producing something like two million dozens of eggs annually; and about 3,300 dozens per day are put through a new drying process. It is said that the plant is run by electric power and that the vacuum method is used to prevent danger of overheating the delicate albuminoid substances. Improvements have been made so that the yolk can be dried in flakes in the remarkably short space of *fifteen seconds*, ready for grinding and yet keeping the natural color and fresh odor. The "whites" cannot be dried so rapidly on account of their more delicate composition; these are put up in both powder and granular forms.

The up-to-dateness of the Tsingtau egg-powder plant is evidenced by the fact that even the shells of the eggs are crushed and

shipped home to Germany, where the article is in great demand among poultry raisers.

Why doesn't some one indulge in calculating the profits of poultry raising in the Phillippine Islands? (*O. W. Barrett.*)

A NEW KIND OF EXPOSITION.

Fairs and expositions are becoming so popular and of such real value to the public that the American Manufacturers' Export Association of New York, has decided to try a new scheme for advertizing American goods, and thus to develop a demand for same in Latin American countries. A ship of 14,000 tons, the *Exposition,* will begin its first tour about October 1, visiting the principal ports of Central and South America, completing the tour to San Francisco in about one hundred and eighty days. This ship will have exposition booths and show cases for display of all sorts of American manufactures and products. Machinery will, of course, be given special attention, but dry goods, drugs, and food products will be very much in evidence.

There is not much doubt as to the splendid success of this novel idea, and the best of the matter is that a similar cruise among the trade centers *of the Orient* is planned at the conclusion of the Latin American tour. It will be a great day for Manila when the *Exposition* comes here. (*O. W. Barrett.*)

CARABAO IN EUROPE.

The carabao is now a subject of thremmatological interest in Transylvania, eastern Hungary. The variety of "water buffalo" of that region is extremely hardy and somewhat larger than our Philippine animal; in fact, adult specimens are said to be commonly met with 1.6 meters in height at the shoulder. The color is a dull black, or black with a white patch on the forehead. Albinos are occasionally met with, of course. The forequarter is considerably heavier than the hindquarter, and the animal is said to be comparatively quick in its movements. During the winter the animals, very naturally, have to be protected by sheds.

It is claimed that the work done by a Transylvania carabao is 40 to 50 per cent above that of a first-class ox. An ordinary animal costs there in the vicinity of ₱150.

Several districts of Italy have used the carabao for many years with good success, the animals reproducing there slowly but surely. Eastern Hungary, however, represents the most northern range of this queer old draft animal. (*O. W. Barrett.*)

THE CHERIMOYA IN CALIFORNIA.

Another of the tropical or rather subtropical fruits heretofore rather neglected is slowly but surely coming into its own. The Pomona College Journal of Economic Botany, Volume II, No. 2, 1912, contains an interesting paper by F. W. Popenoe on the status of this tree and related species in California. As far as is known, the cherimoya was introduced into California in 1871 and has spread until it is now rather common in many parts of the state which are adapted to its culture. However, the cherimoya, in common with so many other tropical fruits, has in California been propagated mostly from seed with the inevitable result that only a comparatively few trees produce really superior fruits. In fact only one variety, the "Golden Russet," is propagated vegetatively at present in California, which variety, by the way, was successfully introduced last spring into the Philippines. The soursop, custardapple and sugarapple do not succeed in California according to Mr. Popenoe, being too tender. The paper referred to is accompanied by many interesting photographs. (*P. J. Wester.*)

BUREAU OF EDUCATION CORN-GROWING CONTESTS.

In Circular No. 65, series 1912, issued on June 13, 1912, the Director of Education has outlined the conditions governing a corn-growing contest that is to be held in each school division. The general object of this contest is to further the growth and use of corn, thereby bettering the food supply of the people of these Islands, and preventing a shortage in the food supply of the Philippines.

Two different contests will be held: Contest No. 1—To determine the largest number of kilos of husked and cured ear corn produced from 100 square meters of land; Contest No. 2—To determine the grower of the best five ears of corn. These contests will be purely school affairs, and the number of entries will be limited.

Contest No. 1 is open to any primary or intermediate pupil of the public schools. Each contestant must without assistance other than plowing the field, prepare, fertilize, cultivate and harvest the products of 100 square meters of land planted to corn. The corn plots must be under the regular supervision of a teacher, and should be at the home of the pupil. All entries should be made by September 1, 1912, and the contest will close on or before March 1, 1913. A "Corn-growing contest card" must be kept for each contestant. Contest No. 2 is open to

any pupil who is either enrolled in contest No. 1, or who is doing gardening as a regular industrial requirement.

A summary of the information contained on the face of the corn-growing contest cards will be submitted to the general office of the Bureau of Education with a report concerning the enthusiasm, difficulties, results and recommendations in connection with either of the corn contests. It is not the intention for the corn-growing contest to take the place of or in any manner curtail the regular garden work in the schools. (*H. T. Edwards.*)

A NEW TEXTILE INDUSTRY.

From the London Chamber of Commerce Journal we learn of a new invention that is said to be causing considerable excitement in the textile world. This consists of a treatment of straw whereby it is possible to produce therefrom a fiber suitable for spinning. If the claims for this new invention are not overstated, the influence of this new material will be far-reaching.

The principal advantages claimed by the inventors are that the new fiber has all the merits of the yarn now produced, that the cost is only one-half that of similar products, that the weight is only 60 per cent of other fibers, and, of course, that the goods are in every way desirable. It is said that experts who have examined this material are agreed as to the truth of the above claims. (*P. J. Wester.*)

FILARIASIS (THREAD WORMS) OF FOWLS.

The trouble becomes apparent by swellings about the head and the joints of the limbs; these swellings are usually painful, the ones about the head occurring in the tear ducts. Where the filarias occur in large numbers the birds frequently die.

Treatment.—By means of a small glass-barreled syringe fitted with a small needle, inject into the swellings eight to ten drops of the tincture of iodine. Usually one injection is sufficient but if necessary it may be repeated in about a week.

It should always be borne in mind in handling fowls of any kind that scrupulous cleanliness is absolutely essential to success. Clean fresh drinking water and clean food should always be provided, and the drinking vessels should be cleaned daily. It is good practice to spray the runs, pens and roosts frequently with a 5 per cent solution of carbolic acid to which has been added chloride of lime in the proportion of 4 ounces to the gallon. This should always be done when filariasis makes its appearance. (*Dr. G. S. Baker.*)

ERRATUM.

In the article upon the Bureau of Health exhibit at the Exposition of 1912, appearing in the April number of THE PHILIPPINE AGRICULTURAL REVIEW, line 9, page 182, the following statement was made:

> The presence of 4 per cent or more of phosphorus pentoxide is considered sufficient to class the rice as unpolished and acceptable.

This statement is incorrect as the line in question should read:

> The presence of *four-tenths of 1 per cent* or more of phosphorus pentoxide is considered, etc.

MONTHLY VETERINARY REPORTS—FEBRUARY, MARCH, APRIL, MAY AND JUNE, 1912.

By Dr. A. R. WARD, *Chief Veterinarian.*

Albay and Ambos Camarines.—Free from rinderpest.

Bataan.—One municipality has rinderpest infection as against four infected towns of February 1.

Batangas.—No rinderpest in this province since February 21.

Bohol.—On March 16 rinderpest was found in Sierra-Bullones, but the province was declared free from the disease on June 24.

Bulacan.—On June 24 rinderpest was found in San Miguel.

Cagayan and Isabela.—Conditions remain the same as at last report. Only one town with known infection.

Cavite.—Free from rinderpest.

Cebu.—The quarantine which was placed on this province for rinderpest on December 29, 1911, was raised on June 10, 1912, by the Honorable, the Secretary of Public Instruction.

Iloilo and Capiz.—These provinces became infected for the first time in years during the month of May from a shipment of cattle and carabao imported from Indo-China. Before the Bureau could put a force of men in the field, the towns of Arevalo, Dumangas, Iloilo, Jaro, Oton, Passi, Pototan, and Santa Barbara, in Iloilo Province, and Capiz, Dao, Maayon, Panitan and Pontevedra, in Capiz Province, became infected. Both provinces have been placed under strict quarantine by the Honorable, the Secretary of Public Instruction. With the Scouts, Constabulary, and Bureau forces now in the field, it is hoped that a further spread of the disease will be prevented.

Laguna.—Rinderpest infection was discovered in this province on May 4, and at the present time the towns of Bay, Lumban, Magdalena and Pagsanjan are infected. This infection came from Indo-China cattle and carabao imported into the Philippines during the month of April. A strict quarantine

was placed on the province against rinderpest by the Honorable, the Secretary of Public Instruction on June 6.

La Union.—Free from rinderpest.

Leyte.—This province is free from rinderpest infection.

Mountain.—Lubuagan is infected with renderpest.

Nueva Ecija.—Free from rinderpest.

Oriental Negros.—Free from rinderpest.

Pampanga.—Seven towns are considered as infected with rinderpest, but the large force of Scouts and Bureau employees working in this district insure the speedy eradication of the disease from the province.

Pangasinan.—Binalonan and Binmaley are infected with rinderpest.

Rizal.—Four towns have recently become infected from a shipment of cattle and carabao imported from Indo-China. The province has been quarantined by the Honorable, the Secretary of Public Instruction. Conditions point to a speedy eradication of the disease.

Surigao.—Hinatuan is infected with rinderpest, but no new cases have been reported for some time.

Tarlac.—No known infection of rinderpest.

Tayabas.—No known rinderpest infection.

Zambales.—Botolan is infected with rinderpest.

General conditions.—At the beginning of the period covered by this report, fourteen provinces and twenty-nine municipalities were known to be infected with rinderpest. At the beginning of the month of May, this had been reduced to twelve provinces and twenty-four municipalities. Since that date new rinderpest infection was brought into Iloilo and Manila in a shipment of Indo-China cattle and carabao. While there still remain only twelve provinces infected with rinderpest, thirty-six municipalities are known to harbor the disease. All that has prevented a greater number of provinces and towns from becoming infected, has been the prompt measures which have been taken and the hearty coöperation on the part of the Scout forces and Constabulary, and provincial and municipal officials.

STATISTICS ON PRINCIPAL CROPS FOR FISCAL YEAR 1911.

[Compiled from the official reports submitted by the executive officers of 1 city, 716 municipalities, 80 townships, 22 rancherias, and 7 settlements.]

By BENJ. P. LUKENS, *Statistician.*

Crop.	Area cultivated.	Product.	Amount produced.	Approximate average value per unit in provincial markets.	Value of coconut products in provincial markets.	Approximate total value in provincial markets.
	Hectares.					
Rice	1,043,757	Cleaned rice	574,842,688 kilos	₱0.1148		₱65,991,940.58
Abacá	404,160	Abacá (Manila hemp)	171,879,598 kilos	0.16		27,500,735.68
Coconuts	208,476	Ripe nuts used as food	154,980,726 nuts	0.03	₱4,649,421.78	
		Copra	118,323,114 kilos	0.15	17,748,467.10	
		Coconut oil	6,602,966 liters	0.30	1,980,889.80	
		Tuba (a beverage)	37,649,880 liters	0.05	1,882,494.00	
		Total value of all coconut products				26,261,272.68
Sugar cane	120,313	Crude sugar and panochas	243,924,574 kilos	0.10		24,392,457.40
Corn	302,516	Shelled corn	186,404,700 liters	0.0468		8,723,739.96
Tobacco	69,015	Leaf tobacco	25,518,132 kilos	0.27		6,889,895.64
Total	2,148,237					159,760,041.94

Equivalents.—1 hectare equals 2.471 acres. 1 kilo equals 2.20462 avoirdupois pounds. 1 liter equals 0.908077 dry quart or 1.0567 liquid quarts. ₱1 (Philippine currency) equals $0.50 (United States currency).

NOTE.—The total area of the Philippines including all islands both large and small was reported twelve years ago by the Manila Observatory to be 119,542 square miles, which is equivalent to 309,615 square kilometers or 30,961,500 hectares.

The amount under cultivation in the six principal crops appears then to be 6.94 per cent or approximately 7 per cent of the whole area of the Islands including mountains and arid lands. Stated in common fractions it would be about one-fifteenth of the whole area.

Since corn is largely planted on land devoted to other crops during part of each year, its area may be considered to partly offset the tracts of land which are known to be cultivated in bananas, camotes, maguey, cacao, coffee, and other fruits and vegetables. Only two of these minor crops have been reported to this Bureau and tabulated, viz: Maguey, 13,346 hectares, and coffee, 1,948 hectares.

Persons desiring detailed statistics regarding crops may obtain the same by sending a written request to the Director of Agriculture, Manila, P. I. A statistical bulletin showing the production of the principal crops by provinces is now being printed and may be had upon application.

PLATE I.—A FULL-GROWN "PAHUTAN" MANGO TREE.

It has never been pruned. The lowest branches should be removed to make it a suitable avenue tree

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VOL. V SEPTEMBER, 1912. No. 9

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURE.

EDITORIAL.

By the DIRECTOR OF AGRICULTURE.

The public press of Manila has recently been writing a good deal about the beautification of the city through the planting of more trees, shrubs and flowers.

This is a subject very near the heart of the Bureau of Agriculture.

The Director, the horticulturist, and other members of the Bureau staff have given out interviews and endeavored to add their quota to the advancement of the idea.

This is a subject which applies with equal force to every city, town and hamlet in the Islands.

Nothing makes a town more livable than the added beauty which results from liberal planting and careful tending of those beautifiers, the trees and flowers.

In many countries there are local organizations known as "Improvement Societies" or by some similar names, the object of whose existence is to foster and encourage such work.

These societies usually go further and provide for the proper care of public parks, playgrounds, cemeteries, and other public or semipublic grounds. Uniform treatment of each street in the matter of variety of trees planted, distance apart and location with reference to street or lot lines is arranged for, and perhaps required by ordinance or order of the proper authorities.

Vacant lots are required to be kept in a sanitary condition and frequently cleared of grass or weeds.

The whole subject has a sanitary and economic value which would alone justify the spending of much effort and money in carrying it out.

Property in such a community is more valuable and desirable than in one where no attempt is made to bring about cleanliness and beauty.

The greater value, however, is perhaps in the educative effect, particularly on the young people. A young man or young woman brought up among such surroundings is not only a better citizen but capable of getting more enjoyment out of life.

There is an almost endless opportunity for such work as this in the Philippines.

One way in which it may be inaugurated is the following:

Some of the men and women in a community desiring to improve the local conditions get together, informally, and decide to start the movement. A public meeting is called to which are invited all those who have the same desire. An organization may be decided upon, or further time may be necessary to crystallize public sentiment.

Eventually, a society is formed, simple in its organization and arranged to get everybody at work.

It is then decided where to begin. Perhaps the streets are almost impassable during the rainy season and need first atten-

tion, or there may be vacant areas that are breeders of disease or mosquitoes. These matters are taken up and corrected first. Then may come the planning as to trees to be planted along the streets or in public parks, or it may be necessary to provide the parks themselves, if there are none.

In fact, the activities of such an organization may become almost numberless, as the work done commends itself to the people.

Very briefly this editorial is intended to open up some of the possibilities of self-help and local improvement, regarding which the Bureau of Agriculture desires to lend its coöperation and assistance in every possible way.

SHADE TREES FOR THE PHILIPPINES.

By P. J. WESTER, *Horticulturist.*

It is a trite saying that, natural advantages being equal, nothing is so influential in promoting the prosperity of the rural districts in a country as good roads. If this has been true in the past with its slow-moving vehicles it is doubly so now with the advent of better and swifter means of transportation, such as the automobile, the bicycle and the freight truck. Good roads link formerly isolated municipalities closer together, facilitate and reduce the cost of transportation of country produce to the cities, and open up areas of land for cultivation that heretofore have been more or less inaccessible. Altogether a good-roads movement tends to eliminate what is complained of as the "loneliness and dreariness of the country," and by facilitating the inter-communication between the farms and estates makes for more sociability and tends to render life in the country much more agreeable.

That the Filipinos are wide awake to the advantages to be derived from good roads is shown in the liberal appropriations for road construction by the Assembly from year to year, and the Bureau of Public Works is gradually extending its network of well constructed roads in the Islands, roads that put many century-old communities in the United States to shame.

The *construction* of the roads in the Philippines, as far as construction is concerned, seems to leave nothing to be desired, but there is still something lacking without which a road is incomplete and without which it does not serve its purpose to the utmost of its capacity—shade trees.

In Europe the desirability of lining the roads and streets with shade trees has long been recognized, as witness the continuous and magnificent avenues of trees along roads of unsurpassed excellence, stretching away through the country, particularly in the western part of the continent. In the United States there has been during the last few years an awakening in regard

to the same subject in connection with the good-roads movement, and avenues of young trees may now be seen growing up in numerous communities.

If avenues of shade trees are desirable along the roads in the Temperate Zone, they are almost indispensable in the Tropics. This position accepted, it merely remains to select trees that will best serve the purpose for which they are to be planted and such as are well adapted to the climate and soil in the region under consideration.

In selecting trees for street or road planting the following points should receive consideration:

1. The general adaptability of the tree to the soil, drainage conditions, precipitation and temperature.
2. Utility for shade.
3. Strength (ability to withstand damage by winds).
4. Immunity from insects.
5. Attractiveness.
6. Longevity.
7. Economic value.
8. Rapidity of growth.
9. Size (in relation to the width of streets).

Good soil with ample drainage will suit almost any tree within its climatological range, but where the soil is poor, sandy, or shallow, the drainage insufficient, or the rainfall limited, considerable care is required in the selection of shade trees in order to obtain the best results.

The general habit of trees varies widely in different species, rendering them more or less suitable for shade according to their growth, those having a moderately tall trunk with a spreading crown being preferable.

The construction of the root-system which enables the tree to get a more or less firm anchorage in the soil, and the relative toughness and brittleness of the wood and flexibility of the branches determine the ability of a tree to withstand devastations by typhoons. These two matters require particular consideration in a country like the Philippines, where terrific winds are of more or less common occurrence.

The control of insect parasites is a serious problem in the Tropics where these multiply far more rapidly than in the Temperate Zone, and trees that are subject to attacks from serious insect pests should therefore be avoided.

The rapidity of growth should be considered. Slow-growing trees are frequently ultimately more satisfactory than those of

quick growth, as the former have in most cases a finer grain, and thus are better able to resist the ravages of typhoons; however, they may not give the desired shade for several years. Quick-growing shade trees may then be planted between the slower-growing ones to provide shade in the interim, with a view to removing them as soon as the permanent trees are sufficiently large.

The ultimate size of the tree when it is fullgrown should be considered in its relation to the width of the street or road, and when the distance between the trees is decided upon, the general appearance and attractiveness of the tree, as well as its leaves and flowers, should not be forgotten in its selection for shade.

It should be remembered that shade trees are planted not only for those living to-day but to benefit coming generations.

The primary object is of course to provide shade, and usually the trees planted for this purpose have no other value. There is, however, no good reason why fruit-bearing trees should not be utilized as shade trees, and thus be made to serve two purposes, having always in mind that the primary object is to provide an all-season shade. In fact, the utilization of fruit trees as shade and avenue trees is in Germany employed on a very large scale, the different communities through which the roads pass auctioning off the fruit produced each season to the highest bidder. This system of utilizing fruit trees for shade on the public roads dates back for many years in Germany. In the small principality of Hanover alone, from 1876 to 1902 the amount realized from the sale of roadside fruit was ₱1,214,792, an average per year of ₱44,984. This system of turning the shade trees into a source of revenue has much to recommend it, and in this respect the Philippines might well emulate Germany, particularly as several of our fruit trees are admirably adapted to this double purpose.

The following species are recommended as avenue trees for streets and roads in the Philippines under ordinary conditions:

Albizzia lebbek Benth.
Cassia siamea Lam.
Diospyros discolor Wild. (Mabolo.)
Diospyros ebenaster Retz. (Zapote.)
Enterolobium saman Prain. (Raintree.) Guango.
Mangifera indica L. (Mango.)
Peltophorum inerme Naves.
Sesbania grandiflora Pers. (Caturay.)
Tamarindus indica L. (Tamarind.)

This may, to many who are familiar with the tree flora of the Tropics, appear to be a meager list. However, it has been limited to these species not only because of their suitability as shade trees but also because they are readily obtainable in the Philippines and do not require extraordinary care and precautions in their propagation. All are propagated from seed. Several other species have been recently introduced by the Bureau of Agriculture, which, it is hoped, will extend the list of suitable shade trees for the Philippines. These will be discussed in a future article in the REVIEW.

Four of the trees enumerated in this list are fruit trees, viz., the mango, tamarind, mabolo and zapote. Of these the mango is the shade tree *par excellence* for the Philippines from every point of view save that of rapidity of growth, which is, however, more than counterbalanced by its other admirable qualities, and which may be remedied by the planting of temporary quick-growing species in the interspaces until the mango trees give the desired amount of shade. The Philippine mango as a fruit of unsurpassed excellence has already won international fame and is our most popular desert fruit. This considered together with its majestic growth and its general utility as a shade tree and that the name mango itself is of malay origin, the mango might well be proposed as the national tree of the Philippines and as such be widely planted. In utilizing the mango as a shade tree it should be remembered that the different types vary in vigor and in order to obtain the best effect trees of a given type should be planted together and not here one tree of the Carabao, then a Pahutan and yonder a Pico. The Pahutan is the most vigorous of all and should be planted about 18 to 20 meters apart; the Carabao and the Pico are less vigorous, a distance of 15 to 18 meters being ample for either of these varieties.

The tamarind with its majestic build, slender flexible branches, and feathery graceful foliage, is a well known fruit tree unsurpassed for beauty that scarcely needs an introduction. The trees should be planted about 15 meters apart.

The mabolo and zapote are less robust and spreading than either species mentioned and require less room, a distance of about 12 to 14 meters between each tree being sufficient.

The guango or raintree is perhaps the most popular shade tree in the Philippines; in order to produce the best effects the trees should not be set closer than 18 to 20 meters apart.

Cassia siamea, one of our handsomest shade trees, suggest-

ing a quite refined, indolent elegance, as few shade trees do, is not appreciated according to its merits and should be more widely planted; about 12 to 14 meters apart is a suitable distance for this species.

About the same distance or a trifle more should be given *Peltophorum inerme* which vies with the preceding species in attractiveness, yet is different in habit and general appearance.

Albizzia lebbek should be planted about 13 to 15 meters apart.

Palms, beautiful as they are in their proper environment, are not well adapted to being used as road trees, as nearly all species have too little spread and give insufficient shade; the more robust ones like the coconut palm almost never develop a straight trunk and are therefore unsuitable. The utilization of palms for the ornamentation of the park and garden is discussed on another page of the REVIEW.

As already stated, the trees in the list embodied in this paper have been selected partly because of the ease with which they may be propagated. In fact their propagation is so simple that no municipality desiring to take advantage of the suggestions offered in this paper need hesitate to procure seed and establish a nursery in which to grow the young trees necessary. This might well be done by the school children of the municipality in the school-gardens that are now being instituted in most towns of the Archipelago by the Bureau of Education. This would also give the children and the coming generation a personal interest in the avenues that they could get in no other way. Wherever seeds of the species referred to in this paper are not obtainable locally the Bureau of Agriculture will endeavor to supply them upon request.

The nursery should be located as far as possible where the soil is loamy, fairly friable, well drained, and sheltered from the wind and, if possible, from the direct rays of the sun. Under an old tree is a good place. The land should first be spaded thoroughly to a depth of about 30 centimeters, all trash and rubbish raked off, and the surface leveled. Unless the land is quite well shaded it will be found advantageous to erect a small bamboo frame and cover it with cogon grass and under this prepare the seedbeds. The seed should be sown thinly, about 5 centimeters apart in rows about 12 centimeters apart, and covered lightly with soil. After sowing the seed, water the seedbed thoroughly, and again as soon as the surface shows signs of becoming dry. As soon as the plants are so large that they begin to crowd each other, say, 15 to 25 centimeters

tall, they should be transplanted to the nursery and set out about 30 to 40 centimeters apart, in rows about 1 meter or more apart. In all cases when plants are transplanted, about two-thirds of the foliage and the tender growth should be pruned off, as should also the taproot and other long straggling roots. Unless the work is performed during the rainy season, with the soil properly moist and the work accompanied by a good rain, the plants should be well watered before and after transplanting. The final transplanting, from the nursery to the avenue, should preferably be done early in the rainy season so that the trees are well established before the approach of dry weather. It is well to remember that small plants are more easily transplanted than large ones; plants 1 to 1.5 meters tall, pruned, are of a suitable size to transplant.

The space required by most trees when they reach their full development to display their full beauty to the best advantage is nearly always so great that as a rule several years' growth is required before they fully occupy the space allotted to them; in the meantime they provide insufficient shade and the avenue looks unfinished. This may be remedied by planting one or two quick-growing trees in each space between the permanent trees, and as soon as they begin to crowd each other the "auxiliaries," as it were, are removed. Trees well adapted to act as fillers are the raintree and the caturay; in fact, the latter species should never be used as a permanent shade tree.

Under all and any circumstances for the best scenic effects, a single species should always be planted in a continued file for a long stretch of road. The alternation of different species of trees in an avenue is an abomination, and is as incongruous and beauty destroying as would be different designs in the columns forming a colonnade; it is the continuity of design and its replication in tree after tree that in this phase of landscape architecture, as in that of the colonnade, produces the beautiful effects seen and admired in a well executed and properly cared for avenue.

In order to give the trees a good opportunity to establish themselves it is well to dig a hole for each tree 1 meter in diameter and about 30 centimeters deep, and in planting the trees to work soil in among the roots and fill the hole with surface soil instead of the subsoil dug out of the hole. It is also important that all trees of a given species be planted at an equal distance from each other and that they be set out in a straight line parallel with the road, or where the road is

curved that the line of trees be curved in conformity. After the trees are planted they should be well mulched and a tree-guard of bamboo about a meter in diameter put up around each tree for protection against animals and children. In order to promote the rapid development of the young tree it is well to keep a space of about a meter in diameter around each tree free from grass and weeds and keep the tree-guard in good repair for at least one year after planting for the more robust and quick-growing species, and for at least two years in the case of those of slower growth.

If the best results are to be obtained it is necessary to train the young trees, for "Just as the twig is bent the tree's inclined."

The training of a shade tree is neither as difficult nor does it require as much attention and pruning as some people would have us believe.

In Europe where everything is more or less stereotyped and formal, and space limited, it is the practice to frequently prune back the trees and thus create a compact and small crown. This may be done to some advantage with slow-growing plants and in the Temperate Zone where the development of the trees is naturally slower than in the Tropics. However, the practice followed in America, to permit the almost untrammeled development of the trees, the pruning being limited to the removal of the lower branches as the tree grows and the heading back of the more wayward growths, is in general more preferable in the Torrid Zone—where the growth of many plants is so rapid that it is readily recognized in a week—than the method of pruning pursued in Europe. The American method of pruning allows the trees to more fully develop and exhibit their natural beauty and to display to the fullest measure the individual attractive characteristics peculiar to each species. The European method is wholly unsuited to most tropical species, which are of rapid growth, and persisted in, soon leaves the tree an ugly, gnarled, dwarfed, mishapen skeleton, with a scant top instead of the majestic, straight-limbed and pleasing specimen that would result from judicious pruning.

The habit of some of the trees recommended as shade trees in this paper such as the mango, mabolo, zapote, and tamarind is naturally more or less compact and symmetrical and only in exceptional cases is it necessary to prune the trees except to remove the lower branches until a sufficiently tall trunk has been formed. In no instance should the distance from the ground to the lowest crotch be less than 3 meters and a trunk 4 meters tall is better. Others, like the deservedly popular raintree and

Albizzia lebbek, grow rapidly, branch irregularly from the very base of the tree, and frequently develop too heavy a top for the weak stem to sustain in an upright position; the young tree falls over, more shoots issue to correct the "irregularities" of the young trees, and if no aid is now given the inevitable result is portrayed on Plate II, *a*. Trees of this habit should be staked and tied when they are planted, using stakes at least 3 meters in height, and retaining them until the trunks of the young trees are sufficiently stout to stand upright without support, or replacing them with new ones if they rot before they have served their purpose. Bamboo stakes are perhaps better and cheaper for this purpose than any other. When the tree is 3 or 4 meters tall it should be allowed to branch for the formation of the crown and from now on this branching should be directed by the occasional heading back of obstreperous and awkwardly growing branches so as to form a symmetrical and natural skeleton frame-work of branches to support the "leafy roof." *In no instance should this pruning be allowed to degenerate into a general and indiscriminate slaughter of the crown branches every few weeks or months,* for this will result in another undesirable type of shade tree not unfrequently encountered. (See Plate III, *b*.)

Trees not unreasonably old, say, having a trunk not more than 10 centimeters in diameter, with ugly and unsightly crowns from the lack of pruning or from too much pruning, may be corrected by cutting off the trunk at the lowest irremediable bend from the ground. A number of sprouts will soon issue from the stump of which the strongest, growing out in a desirable position to make a straight trunk, should be tied to a long stout stake and as the new top is being formed, the surrounding sprouts should be gradually removed (not all at one time, however, for that is apt to seriously shock the tree and produce "frenching" or even kill it). In order to prevent fungi from entering the cut and to facilitate the rapid healing of the wound it is essential that only sharp tools be used in pruning. For the same reason a branch or limb should be severed as close to the trunk as possible and the wound painted with white lead, linseed oil or coal-tar.

Deciduous trees such as the firetree (*Delonix regia*), the mulberry (*Morus nigra*), dap-dap (*Erythrina indica*), and others that remain destitute of leaves, or nearly so, for weeks or months, should never be utilized as shade trees for that very reason, particularly as they are denuded during the hottest season of the year when shade is more than ever appreciated.

HERBACEOUS ORNAMENTALS FOR THE PHILIPPINE FLOWER GARDEN.

By P. J. WESTER, *Horticulturist.*

While a vegetable garden is of primary importance to the majority of people, its ornamentation by the cultivation of a few ornamental annuals adds so much to the attractiveness of the home that no one who has a few square meters of ground should omit the planting of at least a few varieties. If wisely selected, their beauty and the pleasure they give amply recompense the grower for the care and attention bestowed upon them. In the Temperate Zone the annuals that will thrive and that may be selected from the seed catalogue are well-nigh legion; but in the Tropics, contrary to the expectation of many who come here, the reverse is the case, due frequently to the fact that so many of the flowers cultivated in the United States and Europe are indigenous to, or have been cultivated for many generations in a climate very much different from that of the Tropics. The following is a list of annual and perennial flowering herbaceous plants that have been found to succeed in the Tropics, whose propagation is not difficult, and which may be used in the making of flower-beds and borders, or for cut flowers, with the expectation that they will do well, provided that they receive the proper care.

Amaranthus spp.
Angelonia grandiflora.
Anthirrhinum (Snapdragon).
Calliopsis.
Canna.
Celosia (Cockscomb).
Chrysanthemum (Annual).
Coleus.
Coreopsis.
Cosmos.
Dahlia.
Gaillardia.
Gomphrena (Globe Amaranth).
Helianthus (Sunflower).
Helichrysum (Everlasting).
Heliotropium (Heliotrope).
Hibiscus sabdariffa (Roselle).
Iberis (Candytuft).
Impatiens balsamina (Balsam).
Mirabilis jalapa.
Nasturtium.
Petunia.
Phlox Drumondii.
Salvia splendens.
Scabiosa.
Tagetes (French Marigold).
Verbena.
Vinca (Periwinkle).
Zinnia.

Excepting the Nasturtium and the Iberis, the seed of which should be sown direct in the flower-bed, these plants are all propagated from seed, which should be sown in a well protected seed-bed or shallow box, transplanted, and set out in the flower-bed as soon as they are sufficiently large for the purpose. (For detailed directions see Bureau of Agriculture Circular No. 9.)

Some of the plants are perennial and may be propagated by the division of the plants, such as the Angelonia, Canna, and Gaillardia. The Angelonia, Coleus, Heliotrope, Salvia and Verbena are also easily propagated from cuttings, and any desirable

FIG. 1.—Cutting prepared for insertion in the soil.

seedlings of these species that may be discovered near the original plants may thus be readily perpetuated. Fresh-water sand is the most suitable medium for the rooting of cuttings; lacking this a light sandy loam may be used. Put the sand in a box about 10 centimeters deep, the box being placed in a well sheltered shady place. The cuttings should be made about 5 to 7 centimeters long, about two-thirds of the leaves trimmed off, and the cuttings inserted in the sand about one-half, or a little more, of their length, and then well watered and shaded; as soon as they have rooted, transplant into a shaded plat with good garden soil, and, when they are sufficiently strong, transplant to the flower-bed.

ORNAMENTAL AROIDS.

By Ò. W. Barrett, *Chief, Division of Horticulture.*

The Family Araceæ is one of the queerest groups in all the plant world. There is frequently some difficulty in determining off-hand to which family a certain ornamental belongs; an aroid, however, is so strikingly different in nearly all cases that even an amateur can "pigeon-hole" a specimen at sight. Though of vastly different habits as regards foliage, flowers, stems, and soil (or water) preferences among themselves, they have a kind of substantial luxuriance, a lush, rank way of carrying their beautiful glossy leaves, that always makes them striking objects whether in jungle or conservatory, potted or set in the lawn border.

This family, too, can boast of holding some of the very oldest cultivated plants—the taros and yautias—and the *only* ones that *never* produce seeds. Yet, with all their prominent features and great antiquity, the group as a whole has been shunned by botanical collectors, largely for the reason that they could not make good "herbarium specimens" from them—could not dry the juicy tissues before decay would begin. Ask the average botanist to show you a mounted specimen of a taro (gabe) flower, for instance—and count his excuses.

As foliage plants the aroids can scarcely be equalled by any other group. If you would test to exhaustion your color sense and appreciation of complex patterns in leaf ornamentation just walk through a Caladium propagating establishment where, say, one thousand varieties are vying with each other for the ideality degree.

The metallic shades and iridescence of some Alocasias can not be excelled in the Vegetable Kingdom. For striking outline of leaf can anything equal the Anthuriums or our Epiprem-nums (Tibátib), and does any but an aroid dare to display a perfectly fresh leaf full of holes and slits, like the Monstera?

On the other hand, no great popularity will ever accrue to

the aroids through their flowers. To be sure, the old Calla, or as we should now call it, the *Richardia*, and its yellow, spotted, red, and black cousins are famous; and some of the world's largest (but not sweetest) flowers are of this family—as witness the "Stanley's Washtub," and our common Apon (*Amorphophallus*) with its one-kilo boutonnière.

For the amateur horticulturist one excellent character of the aroids is their facility of propagation: few need to be raised from seeds; most grow readily from root or stem cuttings, while others produce bulb-like offsets and corms which can be "held over" dry or "started" at will. Of the latter type, the Caladiums are worthy of very much more attention than they receive here in the Philippines; the few old-fashioned sorts now in evidence in our yards and parks will, let us hope, soon be replaced by the brilliant but daintily colored varieties so common in other countries; even those unfortunates who have little liking for plants cannot fail to stop and examine a good specimen to see whether the crimson spots and splashes are real blood and whether its transparent areas are genuine holes.

The magnificent Colocasias, Alocasias, and Xanthosomas grow readily from root sections and offsets; and these plants always give an air of sumptuous dignity to rockery-pile, a center-bed or even a fence-corner. Varieties can be had from ½ to 2 meters in height; some may seem, to the passer-by, to be merely a glorified gabe, or taro, but the magnificent green, or variegated, purple-stemmed, or marbled-stalked Yautias and Alocasias are in a class by themselves, and a *high* one. They may be massed in beds or placed singly among the shrubbery and lesser herbs.

As climbers the aroids are without equals for a tropical effect. The rank-growing Epipremnums with their aerial roots and ragged-edged leaves are fairly common here already; likewise the odd old Pothos with its gold-blotched foliage—no two leaves ever of the same pattern—is coming into favor. However, there are plenty of other good scandent species. We also hope to see the wonderful *Monstera deliciosa* with its fragrant edible fruit and button-holed leaves a general favorite.

In shaded corners and around very wet areas most ornamentals refuse to even exist; but that is where many of the aroids literally shine. The curiously variegated Dumb-canes, or Dieffenbachias, or some of the Arisæmas, Arums, and Anthuriums revel in plenty of water and shade and are all worth the attention of one who likes to have something a little better than the next-door neighbor's.

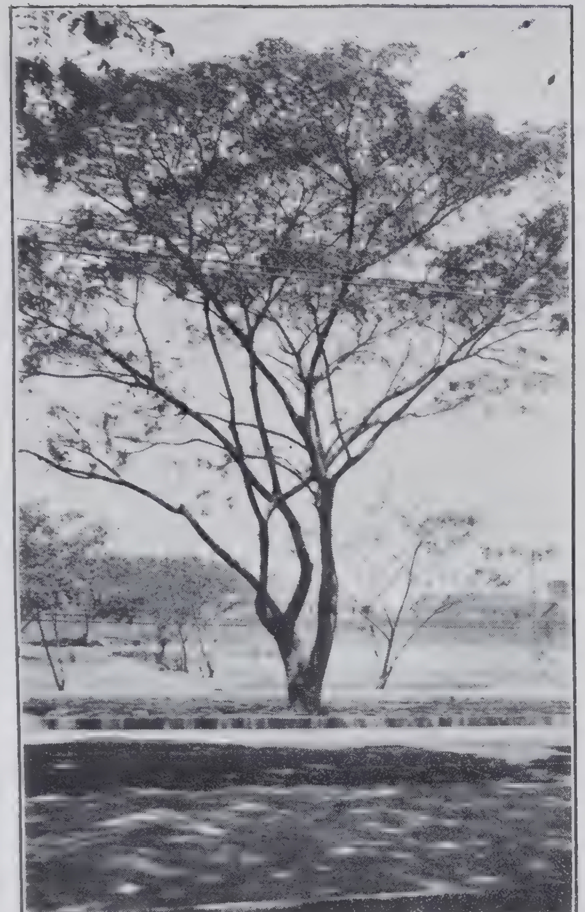
ORCHIDS: THEIR CULTURE IN THE TROPICS.

By P. J. WESTER, *Horticulturist.*

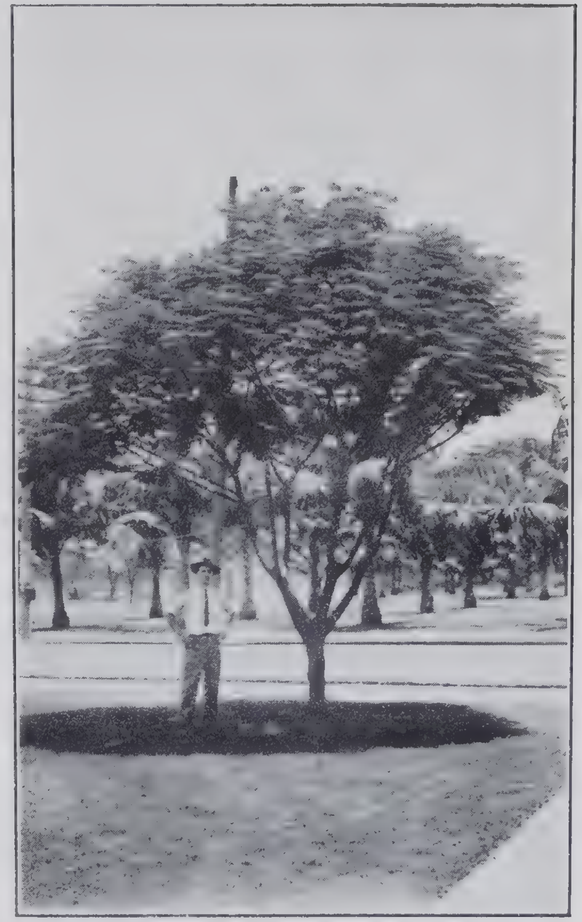
Orchids more than any other class of plants have exercised a fascinating influence upon man ever since they were brought under cultivation; the discovery of many reads like a romance; for the adornment of some conservatory and to satisfy the whim of some wealthy collector, more money has been spent and more lives have undoubtedly been lost in collecting them than is the case with any other distinct group of plants. They were among the first plants to be hybridized, and the orchid hybrids are now well-nigh innumerable; it is safe to say that the pedigrees of the orchid hybrids are more accurate and longer than those of any others.

Orchids may be divided into two classes, terrestrial and epiphytes, according to whether they grow in the earth or attach themselves to the tops of other plants—usually the trunks and branches of trees; the gardener and horticulturist in America and Europe separate them into three classes, "hothouse" or "East Indian orchids," those of the "temperate house," and the "cool-house" orchids, depending upon the altitude and latitude of the place of origin. The term "temperate" is, in this case, rather misleading, for the orchids grown in such a house do not come from the Temperate Zone but from tropical countries with a pronounced wet and dry season. In fact most orchids are found within the Torrid Zone, though some occur at altitudes where snow falls and where the temperature is low even in summer.

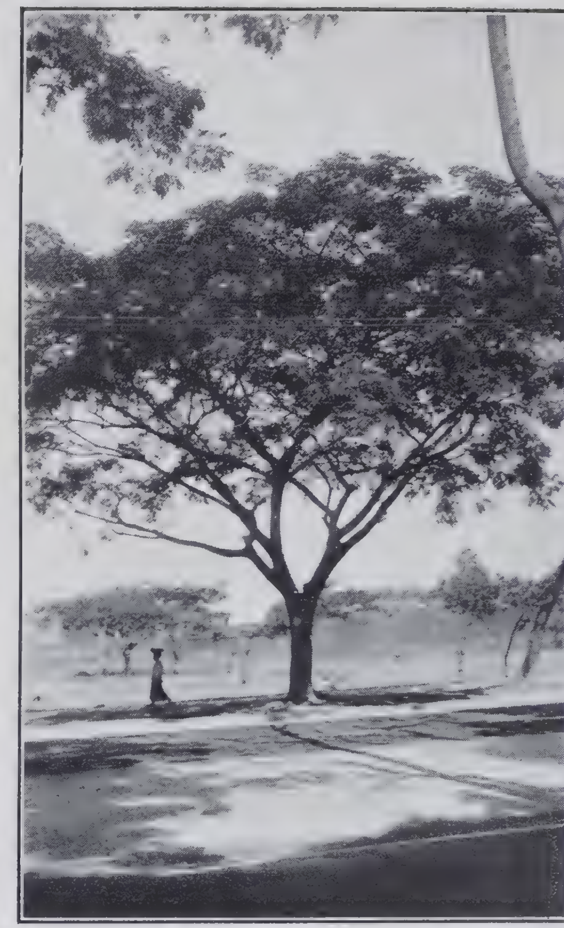
Orchids are still such rarities to most people living in the Temperate Zone, and their proper culture there so comparatively recently understood, that most people regard the orchid as a very mysterious plant, whose culture must also be correspondingly mysterious and difficult. As a matter of fact, neither is true, and in the case of the orchid as with any other plant, in order to be successful in its culture, it is merely necessary to



(*a*) Guango, about 12 years old, the result of no training. (Note the young untrained trees of the same species in the background.)



(*b*) *Peltophorum inerme*, a young tree topped too frequently. It will never become a perfect specimen.

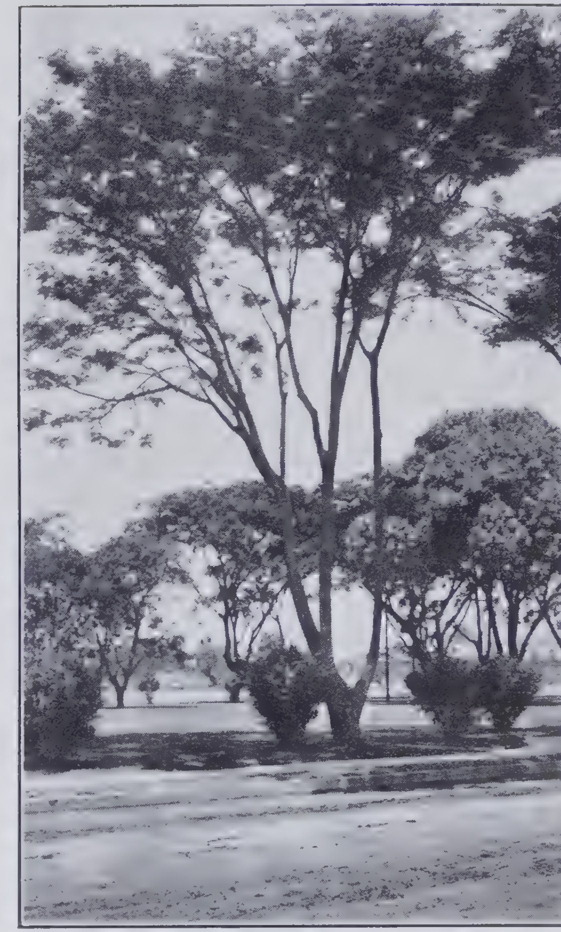


(*c*) A fairly good specimen of the Guango. If the crown had been pruned less from below, the tree would be better proportioned.

PLATE II.—SHADE TREES.

(*a*) Royal Poinciana, about 9 years old; note the knotty ungraceful limbs, the result of too frequent and indiscriminate pruning.

(*b*) A young Guango, the result of overpruning; full-grown, it will never have the straight tree trunk and the shapely limbs that distinguish a well-trained tree.



(*c*) Royal Poinciana, the result of too close planting and injudicious training.

PLATE III.—SHADE TREES.

PLATE IV.—A WIDELY DISTRIBUTED PHILIPPINE ORCHID.

study the climatic conditions under which a particular species grew and to simulate them, and improve upon them, if we can.

Living in a tropical climate we cannot here grow "cool-house" orchids, nor indeed is there any need for lament therefor with the abundance of the tropical material to choose from. In fact, most attractive native orchids can be obtained at a slight cost by any one interested in them. Several species of orchids greatly esteemed in America and Europe grow wild in the Philippines; for instance, several species of *Dendrobium* and *Phalaenopsis*.

There are a number of terrestrial orchids that may be grown in the garden like herbaceous annuals, provided, however, that the drainage is very good. In order to obtain the best results the soil should be largely humus and sand with very little clay and the plants grown in a semishaded position.

Most orchids are epiphytes, however, and because they grow on trees with no visible nourishment, many "orchid fanciers" in the Philippines tack them to a piece of wood and think that an occasional dash of water by the muchacho is all they require. As a matter of fact, the plants, due to their wonderful vitality, live and frequently produce good flowers in spite of this neglect and the owner congratulates himself upon being an orchid grower. This self-satisfaction is based, however, upon the fact that he has perhaps never seen a well-grown specimen, and it is safe to say that with proper culture the quantity of flowers produced would be from one and one-half to two times that obtained with the average care orchids now receive in the Philippines.

As has already been stated, the epiphytic orchids seem to flourish in their native habitats without any visible sustenance. However, they receive more or less from the vegetable matter that collects in the crevices of the bark of the trees where they support themselves and in some cases they send out a stiff "brush" of roots at the approach of the rainy season, pointed upwards and outwards to catch falling leaves, etc., and thus they supply themselves with the best conceivable plant food, and are really far more terrestrial in their habit than a superficial study of them would indicate. In this lies a hint for the would-be orchid grower that few appreciate. As is well known the tropical rains carry a considerable amount of nitrogen which also benefits the plants.

While our orchids delight in a drenching tropical shower, perfect drainage is none the less essential, both during the rainy and growing season as well as during the dry and flower-

ing season, and whatever receptacle is used in which to suspend the plant, it should be constructed so that no water collects and sours the medium in which the plant is to grow. Coconut husks held together by galvanized or copper wire make unique and attractive receptacles for orchids, or baskets may be made of hard, slow-decaying wood. To be attractive and to serve its purpose well an orchid basket should be just large enough to hold the plant without crowding it; if a large specimen is desired, several plants may be put in one basket. About half or more of the basket should be filled with broken pots and charcoal and the plant then "basketted"—that is, planted in the basket. In doing this, place the plant in position in the basket and work in among the roots equal parts of leaf mold and decaying leaves, and bits of charcoal and broken potsherds. Do not set the plant so deep that the buds from which the new growth, or pseudobulb as it is called technically, springs, are *under,* but rather just about *even* with the soil surface. In order to hold the plant until it has taken root wind wire over and around the basket. This work should be done a little before the advent of the rainy season just as the plants are starting into growth, and the plants should be watered sparingly until they come into active growth. If they are not exposed to the summer rains they should be watered regularly and never allowed to become so dry that the growth is arrested. It is also beneficial to feed the plant by watering it with or dipping the basket in cow manure water of about the color of weak coffee every two to three weeks. Lacking manure water, a chemical fertilizer answers very well. The writer has found that the following formula produces excellent results applied at intervals as stated above:

Nitrate of soda	grams	27
Sulphate of potash 49 per cent	do	12
Acid phosphate 16 per cent	do	30
Water	liters	10

The fertilizer should be well dissolved, and the solution stirred from time to time in order to prevent the acid phosphate from settling to the bottom. It is probable that low-grade sulphate of potash or muriate of potash can be used in lieu of the high-grade. Twenty-five grams of either of these fertilizers should then be dissolved in 10 liters of water. If superphosphate is used instead of acid phosphate about 10 grams will suffice.

By this artificial forcing the writer has obtained in one season

two growths instead of one and has doubled the amount of bloom produced.

Any man who is at all interested in his plants will notice when the pseudobulb has attained its full growth. It then swells out and "fattens up," to use the term of the professional grower. The leaves also begin to lose their freshness. If this is well toward the dry season, water should be gradually withheld until the plant is left almost dust dry. The leaves of the deciduous species, such as the *Dendrobium superbum*, so frequently seen in Manila, now fall and later the flower buds appear. Then and during this period of ripening of the pseudobulbs and the season of flowering, supply water sparingly, or barely enough to prevent the pseudobulbs from shriveling too much and the flowers from wilting and the reward will be a fine spray of bloom lasting in some species several weeks before they fade, after which the cycle in the life of the plant is past. If it can be avoided, the pseudostems of a plant, as long as they are in good health, should never be removed for this is a drain upon the vitality of the plant.

Many orchids like the *Cattleya* and *Laelia* and *Oncidium* are not deciduous. However, their treatment is essentially the same as described above; with some of these species it is necessary to withhold water until the entire plant is quite shriveled up before it yields flowers. Likewise certain species of *Dendrobium* may produce fine pseudostems for year after year but fail to bloom until they are properly dried up. On the other hand, certain orchids devoid of pseudobulbs, or stems, such as the genus *Phalaenopsis* and *Cymbidium*, should receive a moderate amount of water throughout the year.

With reference to light it may be stated that the more light and sunshine the plant receives without excessive exposure to the sun, the more flowers will it produce; particularly is this true during the dry season, and during the resting season of the plants before they come into bloom. In this as in other respects the orchid grower can not do better than to study the individual species in their native habitat and environment.

No plants are more fascinating, more royal, coming more direct from the Creator as it were, than many of the orchids; therefore, here in the native home of many of them, where they can be obtained at a mere nominal figure, and where everything is conducive to their luxuriant development, let us have more of them, fill our houses and gardens with them, and enjoy in the fullest measure their beauty and fragrance.

TREES FOR STREET PLANTING AND FOR ORNAMENT.

By Wm. S. Lyon.

For highly creditable achievements in both street-tree planting and in ornamental-tree planting, unstinted praise is due to the municipal government of Manila in general, and in particular to its chief tree-planting executive, Mr. J. C. Mehan.

A goodly share of credit is also the meed of those provincial authorities who, with slender resources, have done much to beautify the surroundings of and approaches to their public buildings.

Per contra; too much obloquy and opprobium cannot be heaped upon the heads of nearly all the foreign residents of the Philippines (citizens of the United States especially included), of whom it is quite safe to assert that 95 per cent have never contributed a single dollar in time or money toward tree planting for the common good, or to *any* planting outside of that prompted by a selfish interest in the plot of land which they perhaps occupy.

Street-tree planting is properly a municipal function and the haphazard planting of the same by untrained enthusiasts is to be discouraged; but this neither extenuates nor excuses the disgrace of permitting vacant urban or suburban lots to become a waste and wilderness of noxious weeds, eyesores, and a public nuisance, when an insignificant outlay would convert them into attractive groves, a credit to the owner, a boon to the present and oncoming generations, and a more lasting monument to the civic pride of the owner than one of stone—especially if it be of so-called "Guadalupe."

A pungent remedial measure applied by boards of assessment would be more effective than miles of written protest and petition.

A trivial reduction in assessment upon well-groomed vacant lots and a corresponding increase in assessment upon the run-to-seed lot, would quickly bring about an improvement in this respect on the part of those who shoot only at the "unearned increment."

The story of how such betterments can be made *profitable* to the owner is for another time.

It should be remembered that every village or tiny barrio is a potential metropolis and that the quagmire carabao trail of to-day may give way to the trolly and the macadam avenue to-morrow. If the wrong trees are planted, and at the wrong distances, or without alignment, lasting mischief has been wrought. Easy to chop them down? In theory, yes; in practice, almost impossible. The cry of "vandal" echoes through the land and a symposium of the "Woodman-spare-that-tree" guild are in arms for the official scalp of the tree executioner.

Sentiment must be reckoned with and properly so. Ninety per cent of all folks who give or care a rap about trees have their favorites; but most times their sentiment comes in conflict with the stringent, almost cast-iron, limitations of appropriate plantations.

As a telling example, where an exuberance of gush was not safeguarded with a knowledge of all the facts in the case, may be cited the red-headed mania of enthusiasm for the street planting of the gorgeous fire tree, or caballero. This found expression in the unfortunate planting of too many of these upon the streets of Manila. Even one tree (for this purpose) would have been one too many. There is nothing of quite such spectacular beauty in the whole plant world, nothing much better suited for parking, and nothing quite so ill adapted to street planting.

Either of its salient and serious defects condemns its utility for this object: One, it buttresses strongly with increasing age and, in time, will rip up the most substantial curbing or paving; the other, it is a deciduous species. Its deciduous habit would be a positive gain were it in gear with our seasons. Unfortunately, however, it becomes wholly defoliated during March, April, and May, our season of maximum heat and sunshine and when we most require street shade. On the other hand, in mid rainy season it supplies the densest shade when we least need it.

For wide streets and avenues, experience has shown that we have nothing better than the raintree, or acacia, as miscalled, and its excellence for this purpose is confirmed by its extended use in many large, oriental, tropical cities.

Here in Manila, from the time of the Spaniards, the mistake of too close planting has been made and, unfortunately, the mistake has been perpetuated in more recent plantings. True, under the excellent systems of typhoon protection afforded them

by frequent toppings this defect of too close planting is not at present observable, but many that are now touching heads will soon be beyond the reach of effective top pruning when they perforce, by crowding, must begin to spindle. There is no single tree in Manila that has had freedom for its perfect development, and of the thousands who pass under our trees daily, it is doubtful if more than a score have ever seen this noble tree at its best, or have an adequate conception of its surpassing beauty when untrammeled.

Thirty meters apart, on streets 40 meters wide, is the minimum at which it should ever be planted and, to afford more crown space, it should be set diagonally at that. There are physical objections, patent to any competent road builder or engineer, which should prohibit their use on streets or avenues less than 30 meters from curb to curb. However grateful the shade to the passer-by, complete and continuous shade is not grateful to the crown of any street paving material known, unless it be perhaps solid stone blocks. The greatest spring, and consequently the quickest escape of surface water from a well-built road is nearest the curb. Here too, it is protected with a paved or cement gutter, hence not so subject to injury from the dense shade of the aligning trees.

For streets of medium width (18 to 20 meters), our so-called yellow cassia (*Peltophorum*) is *facile princeps.* Its one trifling defect (yielding considerable trash) is lost sight of in its many excellencies. For early appreciation of its utility, an appreciation which has found expression in enormous plantings *en bloc,* and without the unpardonable crime of making tree sandwiches, by interspersing other kinds, has left the coming generation deeply beholden to Mr. Mehan. Rizal Avenue is more than redeemed from the stigma of being merely an aggregation of straw shacks and should command international repute as a royal highway. The recent change of its name from Cervantes to Rizal instead of to Mehan, indicates that the present generation did not appreciate its opportunity to render a fiftting tribute.

Tree sandwiches are only admissible where some slow-growing, permanent, and valuable species is wanted, and withal, temporary protection from sun, wind, and dust is desired. Such an illustration is afforded by the new streets of the "Luneta fill," where the extent of the salt deposits admits of question of the durability of the desiderata.

Here, it would be legitimate to interspace them thickly with

"agujas" and Katuday and in two or three seasons at most the economic ends sought are attained.

If the kinds planted "on suspicion" thrive, the others can be exterminated—at night—while the "Woodman-spare-that-tree" clique sleep.

For very narrow streets, or wide alleys, the Palo Maria, the white flowered (Chinese) champaka and the Chinese litchi are three of the best. The former, in loose sandy soils, often becomes a large tree. Where exposed to the dense compacting effect of street and sidewalk making, it rarely attains a height of more than 12 meters. Both it and the champaka form and retain symmetrical crowns with the occasional use of the shears.

To name the litchi (the best of the lot) is to depart from a precedent which forbids the use of any fruit tree upon a public street.

Throughout the continent of Europe there are miles of public highways planted to fruit-bearing trees and this inhibition applies only to the Philippines. It is not to dispute the right of the cedula payer to participate in the fruits of his taxes, but because of his total disqualifications as a fruit harvester. His "get 'em anyhow" methods of fruit gathering are not conducive to the health, beauty, or durability of the tree.

The *seedling litchi* has proven to be unproductive of fruit in Manila to a known age of twenty-six years and is presumably immune from the fruitpickers' depredations.

There is only one avenue (Taft) of magnificent proportions left unplanted in Manila, and in the face of precedent, and of some basic objections, the sacrifice of principle might be justified for the sake of enjoying the unique distinction of having the only great "mango" driveway in the world.

The radical objection is, that some mango trees have a poor root system and topple over. For park planting this is no deterrent, for they continue to cheerfully grow and become more umbrageous than ever.

While this condition could not be tolerated upon a public thoroughfare, the presumption is very strong that the system of close topping now observed in this city, and carried on until no longer practicable, would result in a root development and a stem stocky enough to resist any ordinary typhoon.

Through a most regrettable mistake in the removal of the central line of giant bamboos which once adorned Calles Iris and Azcarraga, we lost our prestige as having the only bamboo-planted avenue in existence. A mere bamboo hedge, such as

aligns half the village streets in the Tropics, is in no wise distinctive. These were in isolated clumps and created a unique, scenic splendor the loss of which is to be deplored. The reduction of the street grade left them stranded upon unsightly hummocks, which should have been remedied with a coping filled in with soil. The extraordinary width of the street would have justified their retention and admitted of the excellent sidewalk planting now in evidence. The only things to compete with this giant grass in scenic effect are palms—an avenue of royal palms contributed as much to make Hawaii known as beer did Milwaukee. Now the day has passed, for they have palm drives on the Riviera and a "Palm Avenue" is a feature of every mushroom village on the Pacific Coast of the United States south of Point Conception.

Among trees planted for sidewalk purposes more or less frequently in Manila, and in very many other towns in the Archipelago, we find the dalisay, or wild almond; the ilang-ilang; the sampalok, or tamarind; the coral tree (*Erythrina*); and various fig species. Recommendations to plant any should be prefaced with "dont's."

The tropical almond, wherever observed, except in Cebu, is the victim of a shot-hole borer which makes its leaves unsightly at all times. The ilang-ilang becomes scrawny and unkempt in time and furnishes insufficient shade. The sampalok, except in very deep alluvial soils, buttresses heavily. The erythrinas, glorious as they are in flower, are subject to rapid decay and, like the fire tree, are leafless in the hot season; and the best varieties of figs are indisposed to thrive if restricted to the normal number of boles allotted to most street trees.

The general ban put upon fruit trees for street planting eliminates the catmon, the santol, and the mabolo. Medium-sized up to large trees of great beauty and hardiness are occasionally seen upon the lines of village streets, but in most cases they have probably been planted within the original abutting property lines for their fruiting qualities only.

Among the most emphatic of all the "dont's" should be included palms of all kinds. Few if any are exempt from insect depredations—depredations which can only be combated at serious cost and untiring vigilance. At best, they furnish inadequate shade, and when young they impinge upon the rights of pedestrians to the sidewalk. Their tenure of life hangs upon the

slender thread of one terminal bud. If this is cut or broken by a falling electric wire, death inevitably supervenes.

The planting of *any* street tree in the Tropics is opposed by the advocates of the "sun bath" and by some people as harboring mosquitos. With any amount of tree plantings, a few stray but ardent sunbeams will for all time be available. Trees may and do harbor mosquitos, but do not breed them. Eliminate their breeding places and there will be none left for the trees to harbor.

SUGGESTIONS IN TROPICAL LANDSCAPE ARCHITECTURE.

By P. J. WESTER, *Horticulturist.*

The Tropics more than any other part of the world is the paradise of the naturalist and plant lover. Nowhere else do we see such exuberant growth and such lavishness of foliage and flowers except in the conservatories in the Temperate Zone, and there the marvelous effects attained under good management are created by the aid of Flora's tropical children transported from their far native homes. Some traveler and naturalist has remarked upon the poverty of floral displays in the Tropics in contrast to the wealth of flowers that adorn the meadows of England. If he referred to the herbaceous flora of the two zones, the Temperate and the Torrid, we may concede the truth of this statement. However, this is a one-sided comparison. The flora in its entirety should be considered; and who will then deny the blue ribbon to the Tropics? Where in the Temperate Zone does one see such magnificent floral displays as a group of flamboyants, *Colvillea,* Banabá, the Barbados "flower fence," the oleander, or *Spathodea campanulata?* Many of the water lilies are of tropical origin, including the most famous of all, the *Victoria regia.* A field—or shall we say a lake—of water-hyacinths in bloom is not likely to be soon forgotten; what temperate aquatic can compete with the royal lotus? and again, are not the Tropics the home of the most gorgeous of those blue bloods of the vegetable kingdom, the Cattleya, the Laelia, the Dendrobium, the Vanda, the Phalænopsis? As if she were not satisfied with having scattered with the utmost lavishness brilliant flowers in the Tropics over the two kingdoms of the earth, land and sea, nature has further endowed the leaves of many of her children among the cryptograms with the iridescent colors of the rainbow, not to speak of the opulent wealth of color in some of the herbaceous shrubs, such as the Codiæums, certain pandans, and Heliconias. Nowhere as in the

Tropics does nature display such protean wealth, from the lofty palms, unsurpassed in stateliness, the willowy bamboo, and the majestic forest trees, to the shrubs and herbaceæ, with an opulence of foliage to satisfy the most exacting, and to the humble ferns yet unsurpassed in grace and loveliness—not to forget the tree ferns, many of which are the *ne plus ultra* of all that is at once stately and graceful, nor the innumerable climbers that are perpetual sources of delight to the plant lover because of their habit, flowers, and foliage.

With all this vegetative wealth at home in usually rich soil, with abundant rainfall and ample natural heat, what remains is merely the tasteful arrangement thereof by the horticulturist and landscape architect, and the subsequent care in order to obtain and maintain the best effects.

In the ornamentation of parks, squares, streets, and avenues of a city, or in the laying out of an estate or a small city lot, utility and appropriateness of every object created should always be obvious; there should always be a reason for a walk here, an open vista there, or a group of shrubbery yonder. It should be remembered that an object that serves no purpose is out of place and that the saying or in words to that effect, that that woman is best dressed of whose apparel one can recollect no detail, applies in no inconsiderable measure to an ornamental ground. If all is harmoniously and tastefully arranged, no single feature should glare us conspicuously in the face, and the whole should give an impression of completeness that would be disarranged by the removal of any one part.

The first requisite for an attractive park or garden, be it large or small, is a good lawn. The lawn is for the park what the background is for a beautiful picture. A good, ornamental garden without a good lawn is as inconceivable as a picture without a background.

Next comes the laying out of the road and paths. In this the width of the road should be considered in connection with its purpose, the greater the traffic the wider the road. A winding road is more attractive and pleasing as a rule than the straight line; but care should be exercised in its design, or it may border on the ridiculous and grotesque.

In the planting of trees due discrimination should be made in order to attain a certain object. Shade should ever be the watchword when trees are selected for the street and avenue in the Tropics, while there are also other points to be taken into consideration. (For a full discussion on this subject see "Shade

trees for the Philippines" in this issue.) There are many exceedingly attractive trees that must be discarded as shade trees and relegated to the park alone because they are deciduous during the dry season when shade is most needed. In the park the selection and grouping together of trees should depend upon their ability to supplement and enhance the beauty of each other whether in habit, flower, or foliage.

Do not crowd too many plants together in a small area. In an effort to have a "little of everything," sight is frequently lost of the appearance of the whole, with the result that the garden becomes a "curiosity shop" as it were, instead of a garden. Not only is it necessary for a tree or plant to have a certain space if it is to attain its proper and material development, but additional space is required to "set off" the object, or in other words, a background. Frequently the best effect is obtained by a solitary specimen tree on the lawn, but if the grounds are ample, a group of trees may be planted to advantage. The ultimate size of a tree or plant should always be considered at the time of planting, remembering that too close planting is not conducive to the attainment of the best effects.

Palms! This single word instantly conjures up visions of the Tropics. As a matter of fact, this distinct family of plants seems to be more used for decorative purposes in the Temperate Zone than in their native homes. Many millions of palms are annually propagated in greenhouses in the Temperate Zone for decoration purposes and used to adorn the houses the year around and the garden and park during the summer. It is safe to say that they are more in demand for this purpose than any other group of plants.

According to their habit and behavior the palms may be used in a variety of ways for decorative purposes. Because of their slow growth and comparatively small spread of crown which gives but little shade, they are not as frequently planted for street trees as they deserve from a purely ornamental point of view. This is a matter for much regret because no shade tree can approach a well developed palm of certain species in clean-cut knightly beauty. A tree may be the most majestic or the most graceful, but the palm is, nevertheless, distinctly in a class by itself. "The princes of the vegetable kingdom," so were the palms termed by the great Linnæus, and there seems to be no reason for a revision of that expression. And yet Linnæus received his impressions of the palms from descriptions by others, from herbarium specimens, and from what must have been but

poor specimens found in the crudely-constructed greenhouses of his day. We can but conjecture his expressions if he had seen the palms in their native habitat. One cannot but regret that the great plant lover and botanist never saw the real Tropics—but to return to our subject. If palms are unsuited to line the wider streets and thoroughfares of a city or the country, they should be planted along paths and walks in the park and plazas whenever this can be done so as to conform to the general design.

For avenue purposes only, species having a straight trunk and a fairly well developed crown should be chosen, such as the Canary Island date (*Phœnix canariensis*), the royal palm (*Roystonea regia*), the California fan palm (*Washingtonia robusta*), *Cocos plumosa*, Buri, *Corypha elata*, etc.; the date (*Phœnix dactylifera*) makes a very satisfactory avenue tree, though it has a rather "stiff" and ungraceful appearance; for narrow walks and the "patio" the "Boñga de China" (*Normanbya merrilli*) is excellent. As an all-around avenue tree perhaps no species surpasses the Canary Island date. The royal palm is indeed excellent when from 5 to 10 meters tall, but it unfortunately grows so rapidly as to lose its greatest charm while it is still comparatively young. For the best effect palms should never be planted so close in the avenue that the leaves interlace. For massing, as solitary specimens on the lawn, or in the shrubbery, all palms may be utilized more or less. For a "grove," particularly near water, none is more appropriate than the coconut palm. In planting a "grove" for ornamental purposes be sure not to plant an "orchard," or else much of the charm will be lost.

The bamboos are of unique beauty, with their graceful, willowy, giant ostrich plumes. Greatly appreciated in far-away countries where they are introduced with difficulty, they are here so common that few stop to appreciate how beautiful they really are.

Shrubs are probably the most abused of any one class of ornamental plants. Who has not seen solitary shrubs standing in line along roads and paths like so many sentinels, prim and stiff, not to say grotesque, and trimmed up like feather dusters from which most of the feathers had been clipped? Sometimes the attempt is made to train a shrub into a tree or some other fantastic shape—with the inevitable result. A man may confess that he is ignorant of other forms of gardening, but he is sure that he knows how to make a hedge and he labors under the

delusion that the hedge is the *sine qua non* in landscape architecture.

As a matter of fact, a hedge is a very serviceable and attractive object *in its place*, and it is sometimes far from unattractive in itself *out of place* if it is properly attended. However the would-be gardener usually "cultivates" it so assiduously with knife and shears that whatever potential beauty the hedge possessed is utterly destroyed and made into hard, ungraceful lines and corners.

The hedge is essentially a windbreak and may be used as a fence or to hide unsightly places, but used on both sides of a road or path it is an abomination, and as unattractive and out of place as a well-arranged border of flowers is attractive and appropriate.

In order to obtain compactness and impenetrability it is necessary every now and then to prune back the hedge; this should always be done with the thought in mind of preserving the natural habits of the plant constituting the hedge as much as possible and yet make it serve its purpose. Among plants eminently well adapted to hedges that also will serve as windbreaks are the oleander, hibiscus, *Acalypha emarginata*, and *Murraya exotica;* for a low hedge, the "violeta" (*Barleria cristata*) is very good.

In most cases shrubs produce the best effects when they are massed; most suitable for solitaires are those of a drooping habit or semiscandent and well covered with foliage from the ground up. Dama-de-noche (*Cestrum nocturnum*), *Russelia juncea, Acalypha emarginata, Pandanus baptisti,* and *P. veitchii* are good examples of shrubs adapted to solitaires; the two last-mentioned species are indeed not shrubs though for ornamental purposes they are used as such, and they may, of course, also be used in massing, either in clumps of one species or intermixed with others.

In massing shrubs the best effects are usually obtained by grouping foliage plants and flowering shrubs in separate clumps instead of mixing them promiscuously. Always place the tallest and most robust-growing species in the background and the smaller ones in front. Especially in a group of shrubs with ornamental foliage avoid planting them in tiers, or the planting assumes an artificial aspect, something that is always to be guarded against.

In making a flower bed avoid intricate and curious designs. A long rectangular bed bordering a walk or a simple circle or an oval in a lawn and triangular beds at the intersection of roads and

paths are the most appropriate designs. Whatever the center of the bed may contain, a border of some dwarf plant with white flowers, for instance, sweet alyssum, is singularly effective; *Pilea* may be used for this purpose, and *Alternantera* is also frequently employed in a similar way.

Climbing plants may be divided into three classes: The woody semibush form (requiring a wooden frame upon which it is trained), of which the *Bougainvillea* and *Allamanda* are good examples; the herbaceous, twining, or tendril-bearing climbers, such as the many species of *Ipomoea, Convolvulus,* and granadilla; and the climbers that attach themselves to the object upon which they climb, such as *Bignonia venusta, Pothos aurea,* several species of *Piper,* etc. The first-named class can be used to the best advantage in covering unsightly objects, walls, etc. A strong frame should be built upon which this class of plants may climb. The more vigorous species of the second class may be used in a similar way and those of medium vigor are particularly well adapted as porch climbers; the third class is particularly useful in covering walls or the trunks of old trees; they succeed best in shaded situations.

If space permits, a very attractive form of gardening is the rockery, which may be built over a heap of refuse and rubbish in a shady situation with enough good soil in the crevices between the stones on the surface to support and nourish the plants. Ferns and Selaginellas, begonias, tradescantias, various aroids, and similar plants, as well as terrestrial orchids, are particularly appropriate in a rockery. If water is available for a small pond, the rockery as an island in the center with a simulated ruin can be used with telling effect, the pond being planted to water lilies and lotus, with here and there a clump of *Cyperus* on the "shore." Bamboos, coconuts, reclining palms, plants of weeping habit, and tall grasses may be planted in the proximity of a pond.

Hanging baskets always adds distinction to a house, be it large or small; and every house should have a few, either of the bird-nest fern, orchids, or combination baskets of orchids and various ferns. Fern baskets made of strong galvanized wire are most satisfactory and lasting, but good baskets may also be constructed of "longlived" hardwood. Coconut husks make very picturesque receptacles for ferns and orchids, and securely wired with copper or galvanized-iron wire last a long time. For small plants, split bamboo joints are attractive and serviceable. but they decay rapidly.

Before closing, the writer wishes to call attention to the neglect to utilize native plants in connection with ornamental gardening, not confined by any means to the Philippines or the Tropics, but universal the world over.

It is true that many of the best effects are obtained by the grouping together of plants from many countries and climes, but it is also true that many exceedingly ornamental plants, which would be an ornament to any garden, are passed by unnoticed because they are wild and common; such ornamental native plants are particularly desirable because they are already adapted to the climate and are usually easy of culture, not to mention that they usually improve in attractiveness under cultivation.

CURRENT NOTES[1]—SEPTEMBER.

A NEW METHOD OF PROPAGATING CACAO.

It may be of interest to cacao planters throughout the cacao-growing regions to know that it has been found that the cacao can be propagated by the simple means of shield budding. A few cacao plants were set out at the Lamao experiment station some three years ago which have, however, been rather neglected and have not been kept in the best condition. During a visit to the station in November, 1911, it occurred to the writer that the cacao, notwithstanding assertions to the contrary by some writers, might be shield budded, and nine buds were inserted experimentally in three stocks November 19. An examination two weeks later showed that all had taken and the stocks were lopped. The buds promptly made a good start though finally only one in each stock made a good growth. It is, however, significant that none of the buds have dried up and died but are still alive (July 7, 1912). The budwood was fairly well matured and care was taken to insert the buds—which were cut very large—in the stock where the growth was of approximately the same age as the buds; the buds were finally covered with wax-cloth. While an experiment limited to so few buds is not conclusive, still the success attained indicates that continued experimentation is all that is needed to perfect this new method of propagating the cacao. The writer will be pleased to have experimenters in propagating cacao communicate their results to him. (*P. J. Wester.*)

ARGENTINE MAIZE.

Argentina has been producing a tremendous amount of low and medium-grade maize, most of which goes to the European market. Last year, however, realizing that the United States was *the* country for high-grade maize varieties, that country imported a large quantity of selected seed and the results were so very good that further tests will be made this season. The

[1] Original notes prepared by various members of the Bureau of Agriculture.

present crop is estimated at 8,000,000 tons, which is, say, three-fourths of the European crop and about one-ninetieth of that of the United States.

Since Argentina intends to increase her live stock at the rate of 10 to 15 per cent per annum (it has amounted to only about $3\frac{1}{2}$ per cent of late years), an unlimited supply of maize becomes a practical necessity. There are now some 13,000,000 head of neat cattle, which is pretty nearly the limit of production considering the comparative shortage of the grain ration. The suggestion is now made that a "prudent limitation to the slaughter of cows" be established.

By the way, is there not a great shortage of maize in every country in the world? And is there any country that needs more maize quite so badly as the Philippines? (*O. W. Barrett.*)

AGRICULTURAL EXTENSION WORK.

For several years the agricultural experiment stations and investigators all over the world have been collecting a large amount of valuable information concerning agriculture. That this information has not been effectively used or put into practice by farmers is a well known fact. Recently, however, an effort has been made in several countries to carry this information to the man on the farm through agricultural experts who, knowing local conditions, make periodical visits to the several farms in their respective districts and demonstrate the best methods of cultivation, etc., that will produce the largest yields on these farms.

During the early part of the present session of the American Congress, the Hon. A. F. Lever of South Carolina introduced in that body of legislators a bill known as the agricultural extension work, or Lever bill, the object of which is to appropriate money from the Federal Treasury to the several State agricultural colleges to be used in organizing a department of agricultural extension work. The idea is to have an agricultural expert in every agricultural county in America. A copy of the Lever bill is given here:

THE AGRICULTURAL EXTENSION WORK BILL, OR LEVER BILL.

SECTION 1. An act donating public funds to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts and of the acts supplementary thereto, a department to be known and designated as an agricultural extension department or division.

SEC. 2. That it shall be the object and duty of said agricultural extension departments or divisions to give instruction and demonstration in

agriculture and home economics to persons not resident in said colleges in the several communities, as may be provided by the States accepting the provisions of this act, and to convey and impart to such persons information on said subjects through field demonstrations by persons skilled in the art, and by publications and otherwise.

SEC. 3. That all printed matter for the furtherance of agricultural work as provided in this act, issued from the agricultural colleges receiving the benefit of this act, shall be transmitted in the mails of the United States and dependencies free of charge for postage, under such regulations as the Postmaster-General may from time to time prescribe.

SEC. 4. That for the purpose of paying the necessary expense of maintaining said agricultural extension departments or divisions, and printing and distributing information on agriculture and home economics, as hereinbefore prescribed, the sum of $6,000 shall be, and hereby is, annually appropriated out of any money in the Treasury not otherwise appropriated, to be paid as hereinafter provided, to each State which shall by action of its legislature assent to the provisions of this act; *Provided*, That payment of such installments of the appropriation hereinbefore made as shall become due to any State or Territory before the adjournment of the regular session of the legislature meeting next after the passage of this act shall be made upon the assent of the governor thereof, duly certified to the Secretary of the Treasury; *And provided, further*, That the additional sum of $3,000 shall be, and hereby is, appropriated for the fiscal year ending June 30, 1912, to be paid as hereinbefore provided, and an annual increase of the amount of such appropriation thereafter for nine years is hereby authorized by an additional sum of $300,000 over the preceding year, and the sum to be paid thereafter to the States shall be $3,000,000 to be used only for the purposes hereinbefore stated; these additional sums to be allotted annually to each State in the proportion which its rural population bears to the total rural population of all the States, as determined by the next preceding Federal census; and, provided further, that no State shall be entitled to any part of its allotment of these additional sums until its legislature shall have provided for the establishment of an agricultural extension department or division in its college or colleges receiving the benefit of this act, and the additional amount to be paid in any year to any State under this act shall be an amount not exceeding the sum appropriated for that year by the legislature of such State for the maintenance of such agricultural extension department or division.

There is no question but that good results will be obtained if the Lever bill becomes law. A similar piece of legislation adapted to conditions in these Islands would also give good results. (*S. H. Sherard.*)

ELEPHANTS IN RINDERPEST REGIONS.

The Philippines are in a way exceedingly fortunate after all regarding the rinderpest situation. This terrible live-stock scourge has been a constant curse to the Asiatic continent for probably many centuries. Rinderpest has undoubtedly shaped the lines of the animal husbandry work to a very great extent

in both China and India; and indirectly it accounts in a measure for the vegetarian habits of the Chinese people, since many generations have been obliged to get along *without beef.*

In Indo-China the same general conditions prevail as in India and China, on either side; elephants, however, have been in constant use in that country for perhaps hundreds, even thousands, of years. In a recent number of the National Geographic Magazine there appears an excellent article on the ruins of the splendid old temples of Angkor Wat, and carved elephants are much in evidence therein. Apparently it is not generally known outside of that country that the natives of Cambodia and to a certain extent also of Indo-China proper still use elephants as draft and riding animals. Two American gentlemen of the Philippines who recently returned from a hunting expedition into that country, however, were pleased with the riding elephants—practically the only means of conveyance in the hinterland wildernesses—and from their information it appears the cost of keeping two or three domesticated elephants in even the small barrios of the interior is so small that every planter or merchant or official of note maintains one or more of these animals in order to have a proper social standing in the community, as it were.

The mountains of Cambodia and Indo-China are said to be full of wild elephants and from these herds young animals are brought in for domestication from time to time. As in Ceylon, India, and Assam, there appears to be no earnest effort, or possibly no intention, towards the breeding of these animals in domestication; and, in fact, it is worthy of note that even in a country like Indo-China where both tame and wild elephants are almost as common as carabaos in the Philippines, the native's idea of the breeding habits of the elephant are ridiculously crude and probably erroneous. But in this matter the Cambodians are no more exasperatingly obtuse than are the people of India on the same subject—or than almost the entire population of Egypt and Arabia concerning the breeding habits of camels.

Let us remember then that districts like Mindanao could, in case of necessity, fall back on elephants as a reserve element in domesticated animal work. (*O. W. Barrett.*)

RATS.

The unusual number of rats which have infested the Province of Occidental Negros during the past year can probably be accounted for by the lack of dry weather in the early part of 1911.

Ordinarily, fire runs over the uncultivated lands and many of those under cultivation during the season of least rain. It seems probable that these annual fires destroy so many rats as to keep them from becoming a serious menace to the cane planters. At no time in 1911 did the grass in this district get dry enough to burn. Consequently the rats had an opportunity to multiply for two years. It has been estimated that 1 per cent of the last crop of sugar cane in this province was destroyed by rats. It is my opinion that immeasurably greater damage was done by their biting into the stalks, but not killing them. The juice from these damaged stalks, in which more or less fermentation was present, seriously interfered with the manufacture of good sugar; in fact, not many sour stalks of cane would be required to reduce a strike of sugar from No. 2 to No. 3 or from No. 3 to húmedo.

Under the system in vogue among the cane planters of milling their cane "paquiao"—that is, paying so much per picul for milling regardless of the grade of sugar turned out—it is not to be expected that the laborers feeding the mill or placing cane on the carrier will throw out damaged stalks.

The iguana frequently found in our cane fields is believed to feed largely on rats when he can get them. Instead of his being considered a very good friend of the hacendero, he invariably falls a victim to the bolo of some cane cutter. (*H. J. Gallagher.*)

NEW CAMPHOR CULTURE.

Some years ago a new method of producing camphor was proposed for the planters of Texas and Florida: Open field culture of seedling plants, to be cut back at the close of the season and the removed portions distilled. This method is, of course, very distinct from the old distillation of chips of the trunks of the old trees which until late years has been practiced in China, Japan, and Formosa. The theoretical success of this young plant-distillation process in America has led the Japanese Government to adopt a similar method for the new plantations of Formosa.

Whereas in the United States the plan was to cut the field of young plants with an ordinary grass mower, the Formosan planters allow the trees to grow fifteen or twenty years before the leaves are removed for extraction of the gum. The present area of leaf camphor in Formosa is, according to the Daily Consular and Trade Reports, some 4,000 hectares; such an immense area could not be economically handled, of course, without very cheap labor.

There are undoubtedly many sections of the Philippines where camphor would do fairly well, but in the vicinity of Manila the trees make only a very slow growth. In the face of the probable future success of synthetic camphor, and of the drop in price of the Formosan article, wholesale camphor production in the Philippines cannot be predicted. (*O. W. Barrett.*)

NOTES ON PAPAYA.

Some years ago, in 1908 to be exact, the writer called attention, in the *Bull. Torrey Bot. Club* (vol. 35, pp. 141–146), to the differentiation of the structure in the hermaphrodite flowers of the papaya (*Carica papaya* L.), and the correlation of this differentiation to the variation in the formation of the fruit, and to a way to breed up a race of hermaphrodite papayas that would come true to seed. The breeding of the papaya has been subject to considerable attention during the last few years at the Hawaii Agricultural Experiment Station as shown by the annual reports from that station for 1911 and 1912. While they do not discuss the subject in detail, the reports seem in a general way to corroborate the conclusions arrived at several years ago by the writer.

About four years ago the writer had under observation a considerable number of papayas in South Florida, which had been obtained from many different parts of the world. One of these plants bore three distinct types of flowers, (1) staminate, (2) hermphrodite, with ten stamens inserted in the throat of the corolla, and (3) hermaphrodite, with five distinct petals and five stamens attached at the base of the ovary.

The Bureau of Agriculture has recently taken up the breeding of papayas and some 2,000 plants were originally set out at the Lamao experiment station in connection with this project. In addition to bearing the three forms mentioned, some plants have appeared here with a fourth type of flower, pistillate. A most interesting fact is that the first flowers appearing on the plants possessing this assemblage of different types of flowers were pistillate. As is well known, the first flowers appearing on the ordinary hermaphrodite plants are staminate. Ordinarily the papaya would seem to be entomophilous, the pollen-bearing agents in the Philippines being to some extent a small species of *Coleoptera.* (*P. J. Wester.*)

DANGER TO COCONUTS.

As an instance of the extreme caution taken in regard to all matters pertaining to the coconut industry in other countries,

the new ordinance recently prescribed by the Straits Settlements and Federated Malay States regarding the introduction of the comparatively insignificant coconut pest, described in the March number of the Philippine Agricultural Review, is of much interest.

Aleyrodes citri, the citrus white fly of Florida, is a name which spreads horror among all conservative horticulturists; and of course any similar sounding name, like *Aleyrodicus destructor*, the exceedingly rare coconut pest discovered by Mr. D. B. Mackie, assistant entomologist of this Bureau, about a year ago, is also a frightful name if not a serious pest. This new regulation prohibiting the importation of "any palms alive or dead, or any stems, or foots (roots?), or parts of stems, or roots of palms, or of any products of palms other than such as are expressly exempted from the operation of this order," from the Philippine Islands, shows rather strenously how alert our neighbors are regarding possible dangers to their coconut groves.

In passing, it may be mentioned that a most excellent coconut pest prevention act has recently been enacted by the Moro Province, which provides for the private or official destruction of all diseased or suspected coconut trees as well as dead stumps or trunks of same.

The Province of Misamis has also recently drawn up a resolution which provides that in case the owner will not fell his own diseased trees, the municipal police may enter the property and take charge of the cutting and cleaning up *with or without* the consent of the owner. The makers of these resolutions looking to the hygiene of coconut plantations cannot be too highly commended. (*O. W. Barrett.*)

NEW OIL TRACTOR.

The Pacific Commercial Company recently imported a Rumely type "F" single-cylinder oil-pull tractor, and an Oliver four-furrow 14-inch (35.5 centimeter) mold-board plow. This outfit was taken to the Malate park where, on July 19, a public demonstration was given, which was very successful. The tractor is 15 horsepower, weight 7½ tons, and uses kerosene for fuel. It hauled the plow easily, cutting a furrow 7 inches (17.7 centimeters) deep in sod land that had not been plowed for fourteen years. One of the best improvements over other kerosene motors is the automatic carburetor. The motor starts on gasoline, and, after a few revolutions, the kerosene is turned on, and after running a short time to allow the cylinder to warm up, the water is then turned on. After this is done no more attention

need be given to it as the governor controls the motor perfectly when the load is on full, half, or when thrown entirely off, and no adjustments have to be made when the load is put on after the motor has been running light for some time. On the average type of kerosene tractors, when the load is thrown off, the water must be shut off and the kerosene closed down, and when the load is put on again, the carburetors have to be readjusted, and, in case of a double-cylinder motor while running light, one cylinder will be cut out. When taking the load again, the kerosene must be cut off, the gasoline turned on until the cylinder warms up and the process of adjusting commences over again. Often the motor will stop in the effort of taking the load again. All this trouble does not occur on the Rumely. Some of the important features are the extra-heavy frame, all rivetted together, the two speeds forward, the wide range and perfect control of the governor, the principal parts being protected from the sand and dust, and the extra-heavy general construction.

This tractor will be taken to the Calamba Sugar Estate and thoroughly tried out in general farm work. Besides plowing, it can be used for driving pumps, threshers, and other machinery. The results of these practical tests will be closely observed by plantation owners who desire to procure a tractor that will give satisfactory service under the conditions found in these Islands. (*Z. K. Miller.*)

STRANGE STOCK FEED.

Dried locusts are known the world over as good food for both man and beast, and since it is an ill wind that blows no good, a locust swarm really possesses potential advantages in the line of food; so that while we hope there will never be an opportunity therefor, we do believe it possible that dried locusts, either in the hopper or flyer stage, could become a commercial commodity here.

A new cattle and pig feed—herring flour—is recently assuming considerable importance in Europe.

The numerous fjords of Norway are the habitat of millions of tons of fish, and among these the herring is always much in evidence. It is now proposed to utilize the surplus herrings which heretofore could hardly find a market even at very low prices. The oil is, of course, used to substitute linseed for paints and since more than 3 per cent oil in a fertilizer stuff is not only useless but dangerous, the removal of oil from these fish

is necessary before grinding them into flour; thus the herring-flour factory has a by-product, the oil, which is worth more than all the expenses of operation.

Haugesund, heretofore famous for its export of kippered-herring and tinned-herring sardines, is now to receive still further notoriety as the seat of two large, new herring-flour factories. (*O. W. Barrett.*)

HOLT CATERPILLAR MOTOR.

We learn from the Daily Consular and Trade Reports of the success of an American motor in Argentina, as follows:

At an official test of agricultural motors recently held by the authorities of the Province of Buenos Aires, the Orory motor, made by Holt & Co., the California manufacturers of the Caterpillar engine, was awarded the competitive prize. Several entries had been made by foreign firms but before the contest took place they all withdrew, with the exception of Holt & Co. The authorities decided, however, to put the American motor through the various tests, in view of the importance to agricultural interests the matter offered. The motor so completely satisfied all requirements that it was awarded the prize, despite it not being subjected to competition.

Recently, one of these motors was imported by the Mindoro Development Company and taken to their sugar plantation in Mindoro and put in operation. In regard to the work of the motor the manager of the plantation states that as a traction engine, the Caterpillar is superior to everything he has tried out, in regard to both the amount of labor performed and economy of operation.

This statement coming from the manager of one of the largest sugar plantations in the Islands, where several different makes of traction engines have been tried out, should be of special interest to farmers, who are contemplating the purchase of traction engines for use in preparing their land. In the opinion of the writer, this type of motor that has an extra large wheel base will be very successful in preparing moist land that easily packs, or in preparing sandy soil that requires a heavy engine to secure a tractive grip in order to draw the load. The moist clay soils are packed so hard by the heavy engines that they are rendered unfit for the production of crops. The advantage of the Caterpillar type of motor can be readily seen, as on account of the weight being distributed over a large area there is as much tractive force as in an ordinary traction engine of double the

weight, and the tractor should be able to work on land when it is very moist, without sinking in, or packing the soil very much. More definite data in regard to the practical operation of this motor will be given later, as the question of traction plowing is of vital importance to plantation owners, since the growing of sugar cane has assumed such an important position. (*Z. K. Miller.*)

ALCOHOL FROM MAGUEY AND SISAL REFUSE.

The sisal planters have been waiting patiently for the chemists to perfect the processes connected with the production of alcohol from the pulp and juice remaining after stripping the fiber from the leaves; until recently, however, the theory has been good but the practice not very remunerative. A new apparatus utilizing a Barbet fermentation process, a Lawrence cooler, and a regular crushing mill similar to those used for cane, is now recommended in an article in Der Pflanzer as the best thing of the kind to date.

It is claimed that 1,000 ripe leaves will yield by this new method about 13 liters of high-grade alcohol and when certain improvements in the fermentation apparatus are instituted, 17 liters will possibly be obtainable. In the future all large sisal plantations will be provided with an alcohol plant, thus saving the residue which heretofore has been not only wasted but a positive danger in the vicinity of the factory. On account of the corroding action of sisal-leaf juice, it must not be allowed to come into contact with tin or iron; the refuse cannot be used even as a fertilizer and it is, of course, useless as a stock food in any form. However, after removing the alcohol from the mixture of pulp and juice, the residue may be mixed with chalk or lime to neutralize the acid and then used for manure.

Another point which makes for great economy on the plantation is the utilization of the stembases, or stumps, of the old plants; it is said that each old stump may be made to yield about $1\frac{1}{4}$ liters of alcohol by the new Barbet method. In Yucatan the life of the henneguen plant is much longer than that of the sisal; in Zambesia the writer has noted a large percentage of the plants (many with leaves of well over 2 meters), in what was perhaps the best sisal plantation in the world, beginning to flower in the fourth year from planting. But even in Yucatan, where plants yield leaf crops steadily for six to eight years or more, it is estimated that on a plantation producing 150,000 leaves daily, there would be some 175,000 stumps to be removed and replaced by young plants each year; and 200,000 liters of

alcohol at even ₱0.10 per liter gives the splendid by-product income of ₱20,000; the leaf alcohol from such a plantation should be worth some ₱70,000.

Wherefore, sisal will probably endure even greater setbacks than it has already met with, and unless abaca can receive some new impetus—as it appears it soon will—the greatest crop of the Philippines will continue to have a very serious rival in the rather unpopular "maguey." (*O. W. Barrett.*)

PHILIPPINE EXPORTS.

In the latter part of July the Bureau of Customs completed the annual statement of exports for the fiscal year 1912. To agriculturists and others interested in the products of the Philippines these latest figures furnish some very useful and hopeful information. The exportations of copra, sugar and cigars show a marked increase both in quantity and value.

The export of copra for the fiscal year 1912 is 169,342,476 kilos which is an advance of 46.5 per cent over the amount exported during the previous year. Its value is quoted as ₱33,029,498, which is 66.8 per cent higher than last year's value. The greater percentage of increase in value over quantity is accounted for by the increased demand and the consequent rise in unit price of copra. Copra now holds first place among the exports of raw products from the Philippines. Abacá (Manila hemp) is a close second and would still hold the lead if the knotted abacá were included as a raw product. This knotted abacá consists of selected fiber of the best grades, the individual fibers being tied together in long strands suitable for use in the manufacture of textiles. It is classified in the Custom House as a manufactured product. Its export represented a value of ₱300,000 in 1910, ₱1,144,026 in 1911, and ₱1,231,538 in 1912.

Abacá (Manila hemp) dropped from 165,649,626 kilos in 1911 to 153,986,928 kilos in 1912. This loss of 7 per cent in quantity was offset by a rise of 8.5 per cent in unit price which brought the value of the 1912 export up to ₱32,567,020 which is an increase of 1 per cent over last year's value. The advance in the unit price of abacá is due to an increased demand for the fiber. The loss in the quantity of abacá exported is due mostly to the abandonment of some of the abacá fields and their conversion into use for other crops.

As was expected, the sugar export shows a steady gain. A rise of 24.5 per cent in quantity and 29.8 per cent in value brings the 1912 export up to 186,016,489 kilos representing a value of ₱20,801,150. Each year new tracts of land are being

cultivated in sugar-cane and during the year 1912 there has been a slight increase in unit value.

Cigars which fell off 32.6 per cent in their value as an export from 1910 to 1911 have almost regained their place in 1912. The gain over 1911 is 32.6 per cent in quantity and 56.5 per cent in value. The total export in 1912 was 175,319,000 cigars valued at ₱5,320,122. The greater increase in value over quantity is due to the shipment of better grades during 1912.

The export of cigarettes has never been a very heavy factor in the tobacco industry. During 1912, 34,955,000 cigarettes were shipped out, valued at ₱64,976. This was a slight increase in quantity and a decrease in value over the fiscal year 1911.

All other forms of tobacco, such as natural leaf, fillers, wrappers, clippings and chewing tobacco are quoted as 12,547,824 kilos, worth ₱3,805,288. This is an increase of about 0.5 per cent in quantity and 1.8 per cent in value over last year.

The greater demand for Philippine copra, sugar, cigars and other tobacco products is a hopeful sign for the producer and is especially encouraging on account of the accompanying increase in unit value. Even in abacá where a slight loss in quantity is already noted and a greater loss may be expected, the value of the commodity per kilo or per picul has increased and indications at present point to a still further advance. This prosperous condition of Philippine exports has more than offset in money value the increase in rice importations. During the fiscal year 1912 the imports of rice reached 260,249,653 kilos which is 28.2 per cent greater than last year's import of that article. Its value was ₱21,139,898, which is 61.1 per cent above the 1911 import value. This large increase in value was caused by the high prices that rice obtained per kilo and per cavan.

During the fiscal year 1911 there were 203,082,707 kilos of rice imported and 574,842,688 kilos raised in the Philippines. Considering that the two quantities together constituted the entire consumption, then the imports of rice represented 26.1 per cent and the production 73.9 per cent. During the fiscal year 1912 the imports of rice have risen to 260,249,653 kilos and the production will probably be less than 400,000,000 kilos (the exact figures for production cannot be stated at present because many of the reports for the period from January to June have not yet been received). Assuming that the production will reach as high as 400,000,000 kilos, that would make a total of 660,249,653 kilos as the consumption for 1912, an amount 15.1 per cent below the consumption of the previous year. This

would indicate that the people affected by the shortage in the rice crop have to a considerable extent subsisted on other food products. The imports for 1912 would represent 39.4 per cent and the production 60.6 per cent of the total consumption.

A tabulated statement of the imports of rice and the exports of copra, abacá, sugar and tobacco is shown on page 524 of this issue of the Review. These data were taken from the annual report of the Insular Collector of Customs for the fiscal year 1911 and the statement for 1912 as published in the Manila newspapers. (*Benj. P. Lukens.*)

FORMOSAN ACTIVITIES.

All the world knows that Formosa has a corner on camphor. The Japan Government is now installing new evaporators and other machinery to increase the previously limited output of the refined gum. The annual yield, with the contemplated improvements in working order, will probably be about 2,500 tons.

Although Formosa has heretofore produced very little Oolong tea, a venture in the line of green tea is now being made by a Japanese tea merchant, who has erected a factory in Koroton, Taichu.

The production of green tea this year will probably be only some 25 tons, which is almost negligible in comparison with the 12,000 tons of Oolong.

Although sericulture has been carried on for some time in Formosa, it is only recently that the Formosa Silkworm Culture Encouragement Association has been organized by the leading silk merchants of Japan; this company intends putting out some 2,000 hectares in the vicinity of Kagi for growing the mulberries, and a silk factory will be erected in the capital, Taihoku. (*O. W. Barrett.*)

COPRA IN SAMOA.

Samoa probably has a right to be considered the most up-to-date copra country of its size in the world. The German Government has instituted most excellent regulations concerning the preparation and standardization of the raw product, and in the prohibition of picking nuts from the trees has gone on record as taking a firm stand against the very reprehensible practice so prevalent in the Philippines—gathering unripe nuts and mixing the comparatively valueless dried "meat" from such nuts with the matured article.

Although American Samoa, known as Tutuila, with its adjacent Manua Islands, contains only 14,000 hectares (54 square

miles), it exported in the fiscal year 1911 some ₱300,000 worth of high-grade copra to the United States and Japan. (*O. W. Barrett.*)

NEW AGRICULTURAL INSTITUTIONS.

As indicative of the growing interest in agriculture in the uttermost ends of the earth, we note that the Spanish Government is just establishing an agricultural school at Melilla in the recently acquired Spanish section of Morocco.

Likewise, the young King of Siam has just sanctioned a project for the establishment of a University of Bangkok; agriculture will enjoy special prominence among the eight faculties in the said institution.

Lower California has been considered about the "jumping-off place" in the way of agriculture, but it will soon have a new agricultural school at San Francisco de Borja.

An organization for fostering agricultural education has been formed at Bilbao, Spain, under the name "Rural Spanish Society." (*O. W. Barrett.*)

MONTHLY VETERINARY REPORT, JULY, 1912.

By Dr. A. R. WARD, *Chief Veterinarian.*

Antique, Capiz, and Iloilo.—Pandan, Antique, was infected with rinderpest on July 20. Only one town remained infected in Capiz as against five when last report was submitted. Seven towns are infected in Iloilo as against eight when last reported, showing a gain of four towns for the three provinces.

Isabela.—One town known to be infected.

La Laguna.—Two towns are infected as against four when last report was made, making a gain of two towns.

Leyte.—Infection was found in Tacloban on July 24 and in Palo on July 25.

Pampanga.—Only four towns are infected as against seven at the end of June, showing a gain of three towns.

Pangasinan.—Three towns are carried as infected as against only two when last report was rendered.

Rizal.—Three towns are at present infected as against four when last report was rendered, showing a gain of one town.

Surigao.—Hinatuan was declared free from disease on July 23.

Zambales.—Botolan still remains infected.

General conditions.—The provinces of which no mention is made are considered to be free from rinderpest. At the beginning of the period covered by this report there were 12 provinces and 36 municipalities known to be infected while at the present time there are only 10 provinces and 25 municipalities known to harbor infection, showing a gain over last report of 2 provinces and 13 municipalities.

COMPARISON OF EXPORTS AND IMPORTS OF THE PHILIPPINE ISLANDS, FISCAL YEARS 1911 AND 1912.

[Taken from reports of the Insular Collector of Customs.]

IMPORTS.

	1911.		1912.	
	Amount.	Value.	Amount.	Value.
	Kilos.		*Kilos.*	
Rice	203,082,707	₱13,121,260	260,249,653	₱21,139,898
Increase .... per cent			28.15	61.112

EXPORTS.

	1911. Amount.	1911. Value.	1912. Amount.	1912. Value.
To all countries.				
Copra	115,602,012	₱19,798,914	169,342,476	₱33,029,498
Increase .... per cent			46.487	66.825
Abacá	165,649,626	₱32,282,680	153,986,928	₱32,567,020
Decrease .... per cent			7.0406	
Increase .... do				0.88
Sugar	149,376,454	₱16,028,720	186,016,489	₱20,801,150
Increase .... per cent			24.529	29.774
Cigars	[a]132,217,000	₱3,401,424	[a]175,319,000	₱5,320,122
Increase .... per cent			32.599	56.467
Cigarettes	[a]33,662,000	₱72,264	[a]34,955,000	₱64,976
Increase .... per cent			3.841	
Decrease .... do				10.085
All other tobacco	12,487,152	₱3,737,446	12,547,824	₱3,805,288
Increase .... per cent			0.487	1.815
To the United States alone.				
Copra	12,240,551	₱2,060,962	24,160,029	₱4,678,288
Increase .... per cent			97.377	126.995
Abacá	66,545,219	₱14,820,746	69,573,526	₱15,502,978
Increase .... per cent			4.551	4.603
Sugar	128,926,454	₱14,289,510	161,782,729	₱18,285,666
Increase .... per cent			25.485	27.966
Cigars	[a]27,936,000	₱1,435,814	[a]67,692,000	₱3,041,508
Increase .... per cent			142.311	111.832
Cigarettes	[a]8,659,000	₱30,786	[a]3,849,000	₱16,466
Decrease .... per cent			55.549	46.515
All other tobacco	14,461	₱16,944	4,945	₱3,014
Decrease .... per cent			65.805	82.212

[a] Number.

PLATE I. CIRCULAR CEMENT SILO AT ALABANG STOCK FARM, ALABANG, RIZAL.

THE PHILIPPINE

Agricultural Review

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CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURES.

EDITORIAL.

THE PRESENT STATUS OF THE ABACÁ INDUSTRY.

Simultaneously with the gradual fall in the price of abacá since the beginning of 1908 came a gradual decline in the condition of the industry in general. The abnormally high prices paid for the fiber between 1903 and 1907 had caused so much enthusiasm on the part of the planters all over the country that abacá was

planted in any locality, under any conditions, and in any manner. While the price remained high the planters realized large profits, but when the crash came many plantations were found to be so badly neglected, having such poor soils, or managed under such unfavorable conditions, as to make impossible the realization of profits from them without the exercise of judicious methods of cultivation in some and a complete renewal of others. These methods, however, were not practised, and worse than that, whatever little attention had been given to the cultivation of the plants and the quality of the fiber was gradually withdrawn, on the foolish plea that the price of the fiber was too low to justify any such expense or trouble. It was, however, a question of only a few months when the natural consequences followed. The quality of the fiber turned out became so low that the price hardly paid for the expense of cleaning it and transporting it to the market; and the economic standing of the majority of the planters began also to decline gradually, which placed them completely at the mercy of the local buyers, whose status was not affected by the decline in the price and quality of the fiber, except perhaps for the better.

Such has been the general condition of the abacá industry for the past three years. The Bureau of Agriculture, through its fiber office, has made every possible effort to induce the planters to adopt better methods of cultivation and fiber extraction, but there has been no general or widespread improvement. There has always been the danger that a calamity in the form of an unusually severe typhoon or an exceptionally long and severe drought might so seriously and permanently injure the industry as to set it back many years. What was feared happened in the latter form, but fortunately with an apparent tendency to cause an effect directly opposite to the one anticipated.

As far as can be learned, the effects of the recent drought, which is claimed by many to be the severest and most prolonged in the memory of the present generation, was to retard the growth of the abacá plants and thus possibly diminish the production of fiber until the young shoots should have matured. In southern Luzon the effect of the drought was more serious, and it is reported that a large number of stalks fell over, thus permanently injuring the plants. This, however, could have taken place only in those plantations which are either too old or are unfavorably situated, in both of which cases their renewal or transfer to better localities is the only disposition that can be made of them.

In Albay, where the drought wrought the greatest damage, the effect may in one sense be considered a blessing to the province as a whole. It seems to have awakened the producers from their lethargy, and to have inspired them with a clear idea as to what they should do to improve their plantations and their product, and also to better their economical standing so as to render them capable of using improved methods of cultivation, which are the only means of checking the effects of future droughts.

This Bureau is watching with a great deal of interest and concern the recent movement in Albay Province, which is referred to in an article in this number and which is expected to bring about the much needed coöperation among the producers, and also the equally needed understanding between them and the local buyers. This Bureau had in fact called a similar convention in Leyte early in May, but of the two hundred, or more, men invited to attend, only twenty were present. The failure to secure a larger gathering, however, was not altogether due to lack of interest, because the time assigned to the convention was inopportune, it being about the end and most exciting period of the elections. We believe, however, that such conventions should be arranged by the provincial boards and held under their auspices; and this Bureau will, if advised of such a project, be glad to send a competent official who will be able to help in an advisory capacity. The conditions of the abacá industry in the other provinces are very similar to those in Albay, and similar attempts to bring about coöperation and understanding between the producers and local buyers in them will also result in a distinct advantage to both parties and in restoring the abacá industry to its former condition of prosperity.

CIRCULAR No. 16.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

MANILA, P. I., *July 7, 1912.*

PINEAPPLE CULTURE.

By P. J. WESTER, *Horticulturist.*

INTRODUCTION.

The exact date of the introduction of the pineapple into the Philippines is not known, but it was introduced many years ago by the Spaniards and plants are now widely scattered throughout the different islands in the Archipelago, where in many places they grow and flourish without any attention. It is, therefore, rather strange that a plant so easily grown and propagated, with a fruit that ranks as one of the best flavored of those of the Philippines, is but slightly cultivated for its fruits, one province only (Bataan) producing pineapples for the market to any great extent. In the other principal pineapple-producing provinces, Samar, Occidental Negros, Tayabas, Bulacan, Leyte, Cebu, and Zambales, the plant is grown more for its fiber than for its fruit. A comparison of our soil and climate with those of pineapple-growing countries in other parts of the world, and a consideration of the behavior of the pineapple in the Philippines, give assurance that with proper care the pineapple will succeed equally well in many parts of the Archipelago.

The pineapple belongs to a family of air plants, and therefore succeeds best in a light, open, sandy, friable, well-drained soil, where there is a precipitation of about 1,500 to 2,000 millimeters falling mainly from June to November. Lacking natural rainfall, irrigation will answer; a judicious amount of water applied during the formation of the fruit will assist in the production of larger and juicer fruits, but water used in excess during the last stages of the ripening produces a watery fruit of poor keeping qualities.

VARIETIES.

The native pineapple is of excellent flavor, but is not always well proportioned; it has too large a crown and too many slips attached to the fruit at the base, and the eyes too deep-set, which are moreover frequently affected with eyeroot, to make it a good variety to plant either for marketing as a fresh fruit or for canning.

In Hawaii and Singapore, the two principal centers for pineapple canning, the Smooth Cayenne, or as it is now called, Cayenne, has long been recognized as the variety best adapted for canning purposes; in fact, it has no rival at present as a canning fruit. This variety is just being introduced into the Philippines and there is every reason to believe that it will succeed as well here as in Hawaii and Singapore. For marketing fresh in near-by towns the Cayenne will be found excellent; for distant shipments, to China and Japan, a hardier variety, such as the Spanish, may be found preferable.

Excellent varieties for the home market are also the Queen (introduced by the Bureau several years ago), the Cabezona, Sugarloaf, and Abakka; the introduction of these latter varieties is now being arranged for by the Bureau of Agriculture.

SOIL.

As already stated, a sandy open soil is best adapted for the pineapple; however, with favorable climatic conditions and proper cultivation the plant succeeds well in heavy soil also. Well-drained land is essential.

Wherever this is practicable, land selected for a pineapple plantation should be free from nut grass or other weeds whose control is difficult. It is good practice to begin the clearing of the land at the advent of the dry season, and after all roots and trash have been removed to turn the land frequently in order to destroy the last vestige of any noxious weeds that may be present. This is particularly desirable where the land is infected with the nut grass or joint grasses.

While this may be done to advantage at all times, it is doubly advisable, not to say necessary, to plant the newly cleared land, where this is infested with noxious weeds, with a leguminous cover crop the first year to choke out the weeds. The Lyon, or velvet, beans are particularly well adapted for this purpose. The land having been cleared and in good tillable condition, the seed should be planted with the advent of the first rains in order to give the plant a good start and enable them to

cover the land before the weeds make headway. If the seed is good, about three beans may be dropped in each hill, the hills being 1 meter apart in the row and the rows the same distance apart. If the viability of the seed is poor, more seed should be planted in each hill. Shallow cultivation is beneficial until the plants begin to cover the land well. At the end of the season the growth should be plowed under and the land prepared for setting out the pineapple plants. For the best results, and to expedite the planting, it is essential that the land be thoroughly cleared of all roots, weeds, and trash before the planting is begun.

PLANTING.

There are several methods of laying out a pineapple plantation, each adapted to the character of the land on which the plants are to grow. If the land is fairly porous or sloping—so that the surplus water escapes easily, either through the soil or by running off on the surface—and free from noxious weeds, the bed systems are the most preferable. Under this term two methods are used: (*a*) The narrow bed, and (*b*) the wide bed. In the narrow-bed systems, the land is marked off into rectangular beds 60 or more meters long, to suit the convenience of the planter, each bed containing six rows of plants 45 to 60 centimeters apart, the plants set out at the same distance in the rows respectively, the pathway between the beds being 135 to 180 centimeters wide. This system allows the weeding of the plants and their fertilization to be done from the pathway without stepping into the field; the fruit may also be gathered from the pathway. In the opinion of the writer this system is preferable to the one described below.

According to the wide-bed system the beds are laid off 10 to 15 meters wide, the plants being set out at the same distance as already indicated in the description of the narrow-bed system, the pathways being somewhat wider. In using this system it is necessary, in the weeding and fertilization of the field, to walk in the bed, and in the gathering of the fruit one man walks through the field breaking off and tossing the ripe fruits to a "catcher" who walks abreast in the pathway.

For flat lands, with heavy soil, where water is apt to become stagnant during the rainy season, and on lands infested with troublesome weeds necessitating frequent weeding, the single and double row systems have been advocated, but it is believed that the advantages derived from the use of either of these systems may be had by the use of a three-row bed with the

additional advantages that more plants can be grown on the same given area and that there is less danger of scalding the fruit through its falling over. In using either the one, two, or three row system, in order to secure better drainage, the land should be bedded up by plowing, throwing furrows together, so that the pathways drain away the surplus water from the land. The pathways should be not less than 120 centimeters wide from row to row.

Whichever system is used, the pathways should be crossed by roads of a convenient width—6 to 10 meters—at suitable distances, in which may be located tramways for the carrying of the fruit to the packing house; on large plantations the tramways should be provided with switches and convenient turntables, in order to facilitate the handling of the fruit trucks.

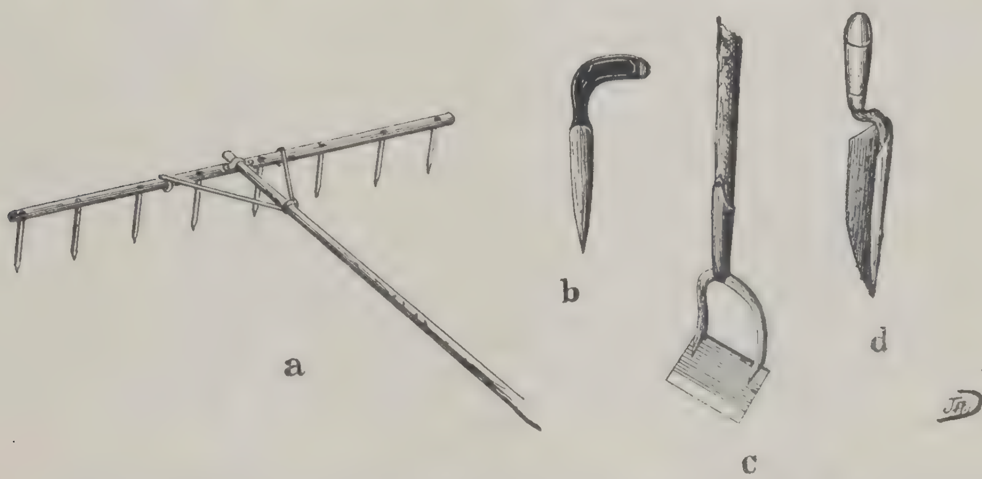


FIG. 1.—Useful implements in pineapple culture: (*a*) Marker; (*b*) dibber, for planting in loamy soil; (*c*) scuffle hoe; (*d*) garden trowel, for planting in sandy soil.

The land being staked off, the beds are laid out with a marker (See Fig. 1, a) which is dragged lengthwise and crosswise over the field, and the plants are set out where the lines meet each other at right angles. The marker may be made of scantlings 3 by 10 centimeters, or of bamboo, and should be about 4 meters wide, and may be described as a very large wooden rake having the teeth very far apart, from 45 to 60 centimeters, according to the distances it is desired to set out the plants in the beds, the minimum distance being used for the small-growing varieties such as the Spanish. The Cayenne should be planted 50 to 60 centimeters apart. At no time should the plants be set out more than 75 centimeters apart, partly because it is a waste of land, partly because the plants cannot cover the land adequately, allowing the free growth of weeds, which increases the work of weeding, and lastly because the

plants then stand too far apart to support each other and the fruit falls over and is apt to become blistered. On dry, sandy land, a garden trowel (Fig. 1, d) is the best implement to use in setting out the plants; on heavier lands, where the soil does not run and fill up the hole, a dibber (Fig. 1, b) can be used to the best advantage.

Practically all pineapple plantations are set out with suckers, which grow out in the leaf axils of the old plant after the fruit is harvested, or slips, which are little plantlets that surround the fruit at the base. The suckers or slips should be prepared for

FIG. 2.—(*a*) Pineapple slip prepared for planting; (*b*) the base of the same slip.

planting by cutting off any diseased, injured, or insect-infested part of the base, and by stripping the lower leaves, under which the stem is mature and has a brownish tinge with the tiny roots protruding (Fig. 2). This assists the young plants in more rapidly establishing themselves, and prevents them from contracting the disease known as "tangleroot." Care should be taken not to strip too close, thus exposing the white, tender part of the stem, as this weakens the plant and frequently kills it. Unlike other plants, it is impracticable to transplant old pineapple plants retaining the existing root system; the old root

system should be cut away and the plant set out like a sucker and allowed to make a new root system.

Where a shipment of plants has been long in transit, say, three weeks or longer, it is well to spread out the plants in a shady place for a few days before they are set out in the field, in order to accustom them to the change.

Where the plants are dependent upon the natural rainfall only, they should be planted at the approach of or during the rainy season, so as to enable the plants to become established, unless the land contains a reasonable amount of moisture throughout the year. On irrigated land, plants may be set out at any season.

In Florida it is necessary to drop a mixture of cotton-seed meal and tobacco dust in the heart of each plant as it is set out to prevent "sanding," but judging from the observations made last year, this does not seem necessary in the heavier and more compact soils in the Philippines, and in this more favorable climate, which aids in a correspondingly more rapid growth of the plants, enabling them to overcome untoward conditions. In sandy soils this use of meal or dust may be found expedient even here, however, for which purpose a mixture of lumbang cake, tobacco dust, and sawdust in equal parts is recommended. Only a small amount should then be dropped in the center of each plant, enough to cover the young leaves.

CULTIVATION.

Until the plants begin to cover the ground and choke out the weeds, the land should be frequently weeded with the scuffle hoe (see Fig. 1, c) or the ordinary hand hoe, the scuffle hoe being preferable on light, sandy soils, the other being more suitable for heavier soils. No cultivation is practicable, or indeed necessary, after the plants cover the ground well, where the bed systems are used, the idea being that planted close, the plants will choke out all smaller weeds; the few larger ones are hand pulled. These systems of planting and cultivation have succeeded well in south Florida on the extremely sandy soil that is characteristic of that part of the State. Artificial fertilizer is there used very extensively, being thrown broadcast over the plants and washed down by the rains, it being impossible to work it in with a cultivator or hoe.

After the fruit is harvested the field should be cleaned of weeds and diseased plants. Where the wide-bed systems are used the plants are, as has already been stated, relied upon to

choke out the small weeds, the large ones being hand pulled. All diseased plants should be removed and the vacant land planted to strong, healthy slips or suckers. The slips and suckers should be removed as soon as they are large enough to set out. Two suckers should be left on each plant to produce the next season's crop. The lower ones are retained; those growing higher up on the plant are removed, as the fruit produced on them is most apt to fall over and become sun scalded.

The length of time a plantation will remain productive depends largely upon the fertility of the land, the variety cultivated, and the care accorded the plantation. In strong, heavy, and weedy land the plantation may be expected to remain profitable for three or four years before it is replanted. On lighter soils which are free from troublesome weeds a plantation may, with good care, remain productive for eight to ten years, or even longer under favorable circumstances. When it becomes necessary to replant the field, the old plants should be torn out and the field planted to a vigorous-growing legume such as the Lyon or velvet bean, Canavalia or cowpea, which is plowed under and the land is then again reset with pineapples. In very weedy fields, it may be found advantageous to plant twice with a cover crop in order to effectually suppress the weeds.

On bedded lands that are apt to wash badly during the rainy season, the soil should be thrown back into the bed around the plants to a depth of 7 to 10 centimeters. This supports the old plants as well as assisting in the formation of a new root system in the fresh soil.

FERTILIZATION.

In Florida the pineapple fields are heavily manured with artificial fertilizer and its use has also been found beneficial in Porto Rico and Cuba, and it is probable that the application of artificial fertilizers will pay in the Philippines also. No fertilizer experiments having been as yet conducted in the Philippines with the pineapple, definite advice cannot be given on this subject.

The following suggestions are offered from the experience accumulated by the growers in the West Indies and Florida, which, it is believed, cannot lead us far astray. At the same time all growers are urged to set aside a part of the field for fertilizer experiments in order to determine which is the most suitable for their particular soil and locality. In such work the Bureau of Agriculture will be glad to coöperate and assist in every way in order that as much light as possible may be shed on this important subject.

The following artificial fertilizers, which have been found beneficial, and which are without any deleterious effects, even when thrown broadcast over the growing plants, may be obtained in Manila. They should not be applied when the plants are coming into flower, or deformed fruits are liable to result.

Name of fertilizer.	Composition.		
	Nitrogen.	Potash.	Phosphoric acid.
	Per cent.	*Per cent.*	*Per cent.*
Dried blood	14.5		
Tankage	4.		22
Paniqui guano	8.5		3
Bonemeal	5.		20
Sulphate of potash		49	
Basic slag			20

The mixtures recommended below are based upon the supposition that the ingredients have the above analysis. If a certain ingredient has a different analysis, the amount applied should be greater or less corresponding to the analysis of the fertilizer.

Basic slag should never be mixed with any organic fertilizer, such as dried blood, tankage, guano or bonemeal as the lime contained in it liberates the ammonia in the other constituents.

First application.—The first application may be made shortly after the plants have been set out and should consist mainly of a nitrogenous plant food, such as dried blood or lumbang cake. About a heaping tablespoonful of dried blood is sufficient, and should be dropped around each plant. The lumbang cake being less concentrated, more than twice this amount may be applied of the fertilizer. Paniqui guano may also be used though it contains rather an excessive amount of phosphoric acid. When the plants are established and become of fruiting age, they require potash and phosphoric acid in addition to nitrogen in order to do their best; in fact, the second application should be a well balanced fertilizer. For this purpose the application of 45 kilograms of nitrogen, 80 kilograms of potash and 36 kilograms of phosphoric acid per 10,000 plants per year is recommended in applications and quantities as will be mentioned presently.

Second application.—This application should be made two to three months after planting and supply 18 kilograms of nitrogen, 18 kilograms of potash, and 9 kilograms of phosphoric acid in the following quantities:

Dried blood	kilograms	125
Sulphate of potash	do	35
Basic slag	do	45

or,

Dried blood	kilograms	115
Sulphate of potash	do	35
Tankage	do	40

or,

Paniqui guano	kilograms	200
Sulphate of potash	do	35
Bonemeal	do	15

or,

Dried blood	kilograms	110
Sulphate of potash	do	35
Bonemeal	do	45

Third application.—The third application should contain 13.5 kilograms nitrogen, 27 kilograms potash, and 13.5 kilograms phosphoric acid, and should be applied six months later which will be in April or May provided that the plants were set out in July or August.

Dried blood	kilograms	90
Sulphate of potash	do	55
Basic slag	do	65

or,

Dried blood	kilograms	70
Sulphate of potash	do	55
Bonemeal	do	65

or,

Paniqui guano	kilograms	140
Sulphate of potash	do	55
Tankage	do	40

or,

Dried blood	kilograms	75
Sulphate of potash	do	55
Tankage	do	60

Fourth application.—The fourth or last application should be made about two months before the advent of bloom or in October or November for plants set out fifteen to sixteen months previous. Nine kilograms nitrogen, 45 kilograms potash, and 13.5 kilograms of phosphoric acid should be applied, as follows:

Dried blood	kilograms	62
Sulphate of potash	do	90
Basic slag	do	65

or,

Paniqui guano	kilograms	85
Sulphate of potash	do	90
Tankage	do	50

or,

Dried blood	kilograms	40
Sulphate of potash	do	90
Bonemeal	do	65

or,

Dried blood	kilograms....	45
Sulphate of potash	do........	90
Tankage	do........	60

Subsequent applications.—After the plantation is well established and has produced its first crop, 27 kilograms of nitrogen, 26 kilograms of potash, and 18 kilograms of phosphoric acid should be applied in the following combinations as soon as practicable after the fruit is gathered:

Dried blood	kilograms....	185
Sulphate of potash	do........	75
Basic slag	do........	90

or,

Dried blood	kilograms....	150
Sulphate of potash	do........	75
Bonemeal	do........	90

or,

Paniqui guano	kilograms....	290
Sulphate of potash	do........	75
Bonemeal	do........	45

or,

Dried blood	kilograms....	160
Sulphate of potash	do........	75
Tankage	do........	80

The following amounts of fertilizer, supplying 18 kilograms nitrogen, 54 kilograms of potash, and 18 kilograms of phosphoric acid, will be found useful before fruiting:

Dried blood	kilograms....	125
Sulphate of potash	do........	110
Basic slag	do........	90

or,

Dried blood	kilograms....	100
Sulphate of potash	do........	110
Tankage	do........	80

or,

Paniqui guano	kilograms....	170
Sulphate of potash	do........	110
Bonemeal	do........	65

or,

Dried blood	kilograms....	95
Sulphate of potash	do........	110
Bonemeal	do........	90

The formulas and amounts recommended above have been used on sandy soils in the West Indies and it is probable at least that much of the land in the Philippines does not require such heavy applications; particularly is it likely that in loamy soils with

a fair amount of humus, the nitrogen may be omitted or very small amounts used after the plants are well established.

A luxuriant growth of the plants with few fruits indicates an oversupply of nitrogen in the soil; in such cases, a good application of potash, say, 90 kilograms of sulphate of potash analyzing 49 per cent, applied three weeks to a month before the advent of bloom will be found beneficial.

YIELD.

The yield depends upon so many factors that it is difficult to make a definite statement. With intelligent cultivation and favorable climatic conditions, from 75 to 85 per cent of the plants may be expected to bear fruit; some growers in Florida frequently obtain over 95 per cent.

HARVESTING.

No hard and fast rule can be laid down as to when the fruit should be gathered, as this depends upon the distance the fruit will have to travel before it reaches the consumer. In any event it must be picked not later than when it begins to "show color" for long-distance shipments, or even quite green. This is something that every grower must determine for himself. If grown for canning purposes, as undoubtedly it principally will be in the Philippines, with the factory near the plantation, the fruit should be gathered as soon as as it is fairly well colored.

Great care should be exercised in handling the fruit and to avoid crushing it, as in the event that the fruit is shipped fresh to distant markets, if bruised, it will have spoiled and become unsalable before arrival, and even canned fruit, injured before the canning process, does not make a first-class product.

Excepting for near-by markets, the fruit, if it is picked during the dry, warm season, should be placed in a cool, dry, open place over night to cool off before it is packed. Fruit that is gathered during wet weather must be dried before being packed. For this purpose set the fruit upside down so that the water can easily drain off the crown.

Fruit that is intended for long-distance shipments should be packed in well-ventilated boxes of a convenient size for handling, and the crates should be made as light as possible commensurate with sufficient strength to stand the handling during transit. In Florida, Porto Rico, and Cuba a crate approximately 25 by 30 by 90 centimeters is used extensively. The fruit is there graded to the following sizes: 18, 24, 30, 36, and 42, according to the

number of fruits that are packed in each crate. Each fruit should be wrapped separately in tissue paper. The object in grading, sizing, and wrapping is to obtain a uniform and attractive pack, for such fruit always brings a better price than when the fruit is packed promiscuously and carelessly. Care should always be taken to pack the fruits so that they never shake in transit.

When the fruit is grown for canning, it is, of course, delivered in bulk and the sorting done at the cannery.

In a cannery the chief product will always be canned fruit, but it should not be forgotten that there is also a considerable demand for crushed and grated fruit, that there is a good demand for pineapple flavoring extract, and that excellent wine may be made from the fruit, in the making of all of which products much of the culls and injured fruits can be utilized.

INSECT PESTS AND DISEASES.

Grown on a soil adapted to its culture and receiving the proper care, few plants are so exempt from insect pests and diseases as the pineapple. Sifted down, the really serious troubles of the pineapple are the mealy bug and wilt. The red spider sometimes appears in sufficiently large numbers to be regarded as a pest.

The mealy bug is the only insect pest of importance; it attacks the leaves at their base and is usually distributed by ants. At the Porto Rico Experiment Station a kerosene and crude carbolic acid emulsion was found to be an effective remedy for this insect, prepared according to the following formula:

Kerosene	liters	15.0
Crude carbolic acid	do	.9
Soap	kilogram	.5
Water	liters	7.5

Dissolve the soap in boiling water, together with the carbolic acid, and while still hot add the kerosene. Churn the liquid steadily for fifteen or twenty minutes by the use of a force pump, the liquid being pumped back into the vessel until it is emulsified. For spraying, dilute each liter of the emulsion with 18 liters of water.

In spraying for mealy bugs, it should be remembered that the force of the spray should be sufficient to penetrate the mealy covering of the insect and saturate its skin in order to be effective. It is, therefore, necessary to direct the spray into the heart and between the leaves of the plant. The ants should also

be eradicated by spraying into their nests. In order to reach all it is usually necessary to spray the nest two successive days.

If the plants are suffering from a very serious attack and the affected area is not large, perhaps the best remedy is to take out the plants and burn them, insects and all.

Red spiders sometimes cause injury during prolonged dry weather, but they are readily exterminated by the use of tobacco dust, which is scattered over the plants. Like the mealy bug, the red spider attacks the plant at the base of the leaf.

The pineapple scale has never been known to occur in sufficient numbers to cause serious trouble.

The wilt is due to a fungus (*Fusarium* sp.). This disease is characterized by the loss of color in the leaves, which change from green to a sickly red and yellow, at the same time shriveling and wilting.

The organism that causes the wilt inhabits the soil and the disease cannot, therefore, be treated like ordinary fungus parasites.

All diseased plants should be pulled out and burned, and the land affected covered with quicklime and left to lie fallow. The soil should in the meantime be stirred from time to time. After two months the land may again be reset with healthy plants. Under no circumstances should plants suspected of having the wilt be set out in a new field.

Sun scald or blistering is not a disease and is caused by the falling over of the fruit so that one side of it is exposed and blistered by the direct rays of the sun. The sun scald can be prevented by shading the fruits that have fallen over with handfuls of straw or grass.

Tangleroot is a condition of the roots caused sometimes by the failure to strip the slips or suckers before they are set out, or by hard soil which cannot be penetrated by the roots. It is characterized by the roots winding around the stems instead of growing out in the soil. The remedy is preventative and consists of sufficient stripping of the basal leaves of the plants at the time of planting and thorough preparation of the land.

Spike is a physiological trouble induced by the use of improper fertilizers, such as acid phosphate, kainit, and wood ashes, the use of which should be avoided.

In conclusion it may be said that if the suggestions offered in this paper are properly carried out, there is apparently no reason why pineapples cannot be successfully grown in the Phil-

ippines. The cost of planting and cultivation and the profits have not been discussed here for the reason that these depend upon so many variable factors, such as the condition and price of land, cost of planting and of labor, accessibility to the market, etc., that estimates would be of little value.

Great care should be exercised in importing plants from abroad in order that no new serious insect pests or diseases may gain entrance into the Archipelago, for with the entrance of each pineapple pest, the profits of a pineapple plantation are reduced correspondingly.

113202——2

CIRCULAR No. 17.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF AGRICULTURE.

MANILA, *July 28, 1912.*

CORN CULTURE.

By SAM H. SHERARD, B. Sc., *Agricultural Inspector.*

SELECTION OF SEED CORN.

Soil, climate, and the length of the growing season vary so much in different countries and in portions of the same country that it is very important that corn should be bred up in each neighborhood. If we bring seed corn from another country and plant it directly in our fields, we will not get a maximum yield the first year because the seed was not acclimatized, nor was it "at home" in our soil. If, however, we select the best ears of those produced the first year and plant kernels from them in our field the next, we will get a better crop of corn than we did the first year because the seed used in the second planting is more accustomed to our soil; if we keep selecting the seed from the best ears each year, after a while we will have produced a variety of corn that is suited to the Philippines and will produce more per hectare than any other kind. In a like manner if we select the best ears from the varieties of corn at present growing in the Islands and use them for our next seed, we will get a larger yield than if we had not selected the seed.

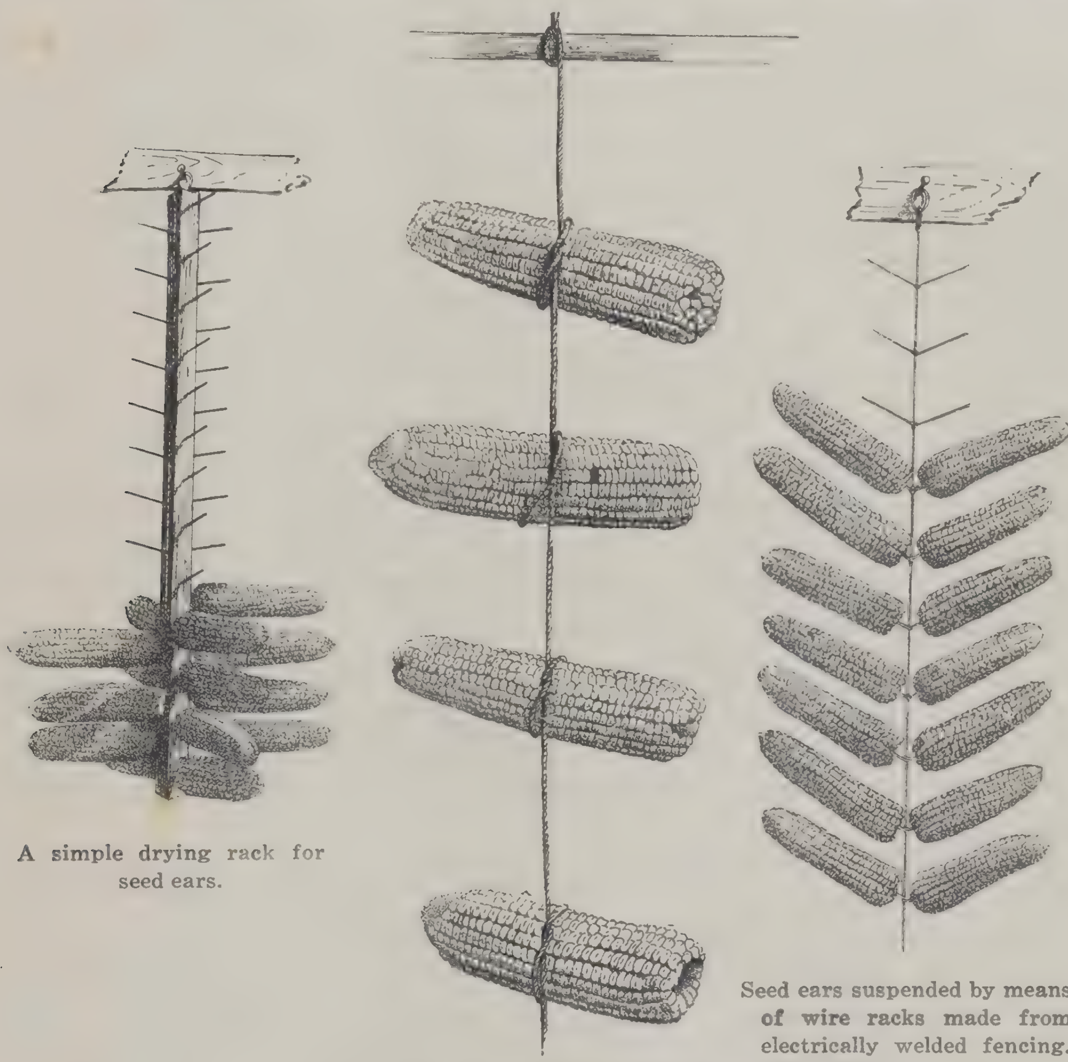
Any planter who produces a strain of corn that is well adapted to these Islands will be able to sell good seed at a price profitable to his neighbor as well as himself, and he will be a benefactor to his locality by increasing the production of corn therein.

The object in selecting seed corn is to produce a variety of corn that will make more shelled corn per hectare than has ever before been produced in the Philippine Islands.

The seed (*kernel*).—A kernel of corn contains a very small germ which, when planted, will make a stalk of corn, and if the seed we use is not the best, in a short time the strain will "run

out," and we will harvest a small yield of ears. The stalks will be scrubby and yellow with only undeveloped ears on them. Then, too, unless we select good ears for seed, disease and insect enemies will develop to such an extent that corn growing will become unprofitable.

A good stalk of corn.—Since the stalk is the individual, it is therefore necessary to select seed ears from stalks that are well



A simple drying rack for seed ears.

Seed ears suspended on cord from poles.

Seed ears suspended by means of wire racks made from electrically welded fencing. (F. B. 415.)

FIG. 3.—Method of Treating Seed Ears.

developed, and this can be done only by selecting from standing stalks in the field at ripening time. Thus we are able to select seed corn from stalks that have produced heavily under average field conditions and in competition with other stalks in the same field.

In the Philippines a good stalk of corn should be between 2.5 and 3 meters high without suckers, thick at the base, with

well-developed roots, and gradually tapering toward the top. The stalk should be free from "smut" or other diseases and should have from twelve to sixteen well-formed blades and two good ears attached by an ear stalk or "shank" 8 centimeters in length. The ears should be 120 centimeters from the ground, should be well covered by the husk, to guard against weevils, and should point downward.

A good ear.—The ear should be nearly cylindrical in shape, well rounded at each end. The rows of kernels should be straight and compact, commencing close to the "shank" and extending clear over the end of the cob to the tip. The cob should be neither too large nor too small. It should be about one-half the diameter of the ear at a distance of one-third from the butt. The kernels should fit snugly and be uniform in size; be nearly flat on the sides, fairly long, and slightly tapering on both edges or "wedge shaped."

Selection in the plat.—When the ears have silked, go through the plat and cut down all stalks that have not started an ear. Then, just before harvesting, go through the plat again and select and mark those stalks that have two good ears on them. Later on, when ready for harvest, these selected ears should be removed from the stalks with the husks on, and should be placed in a dry place where weevils and rats cannot get at them. They should be examined from time to time to see that they are dry and that insects and vermin have not molested them.

Before planting time the seed ears should be tested by planting five grains or kernels from different parts of each in a germination box.

TESTING SEED CORN.

Three hundred and two thousand, five hundred and sixteen hectares of land were planted in corn in the Philippines in 1911 and 186,404,700 liters of shelled corn were produced in that year, an average of 616 liters per hectare. This is indeed a very poor average!

Though some provinces produce only four cavans per hectare, practically every province in the Archipelago can be made to yield over thirty cavans per hectare if more attention is paid to the cultivation of the growing crop and to the selection and testing of all seed corn that is to be planted in our fields. If each kernel of corn that is planted germinates and makes a vigorous stalk, we will have a good stand of stalks in the field. If this happens all of the ground will be occupied, and in cultivating no time or

labor will be spent in working those places that contain vacant hills. Now in order to get a good stand of stalks in our fields, we must plant corn that will produce a good stalk for each kernel planted, and to get such, it is necessary to test our seed corn at home. This can easily be done if the following instructions are carried out:

A home-made germinating box.—Take an ordinary box 30 centimeters wide and 45 centimeters long and saw off the top part so that the bottom will have sides 7 centimeters deep. Cut holes in the bottom for drainage. Fill this tray with sand, then level it and mark off into 5-centimeter squares. By driving tacks 5 centimeters apart on the sides and ends of the tray and running twine across, this can be effectively done. Number the ends and sides from one to ten. Next take the ears that are to be tested

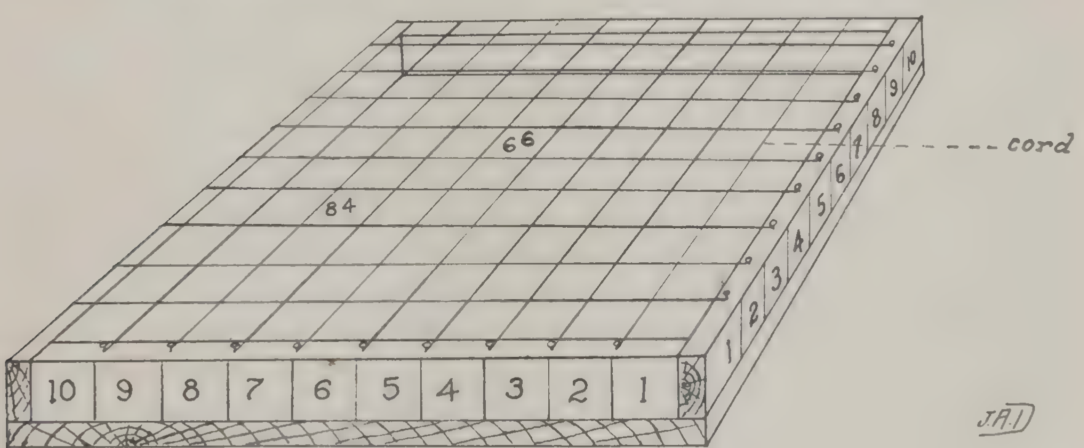


FIG. 4.—A Homemade Germinating Box.

and arrange them side by side on the floor or ground with the butts toward you. Now pick out the most desirable ears and number them to coincide with the numbers of the squares in the tray. Then grasp ear No. 1 firmly in the left hand, pointing the butt away from the body, and with a dull pocketknife or similar instrument remove a kernel 4 centimeters from the butt and place it 2 centimeters deep in one corner of square No. 1; give the ear a quarter turn to the right and take another kernel about 7 centimeters from the butt and place it in another corner of square No. 1; give the ear another turn and take a kernel 7 centimeters from the tip and place it in another corner of square No. 1; give the ear still another turn and take a kernel 5 centimeters from the tip and place it in the remaining corner of square No. 1; then turn again and take a kernel 3 centimeters from the tip and place it in the middle of square No. 1. The ear

has now been turned completely around and five kernels have been taken from different parts of it. Now take ear No. 1 and put it in a place where it will not be moved or get mixed with other ears. Then take ear No. 2 and remove the kernels in the same way as from ear No. 1 and place them in a similar manner in square No. 2. Continue until all ears have been treated. Then take a sprinkling pot and thoroughly wet the sand in the tray; then place the tray in a shady spot and water it from time to time. In from five to seven days the kernels will have germinated. Examine each kernel in every square; and if all have vigorous sprouts, each ear has germinated 100 per cent and we have good seed corn; however, if more than one kernel in any square has failed to germinate and produce a healthy plant, do not use the seed from that or those ears for seed.[1]

What the germination test will show.—The germination test shows that the kernels from several ears do not sprout at all; these ears are dead. The sprouts from some of the ears are short and sickly. Such seed will not grow if conditions are at all unfavorable. The kernels from some ears throw out strong, vigorous sprouts. This is the kind of seed that makes a good stand, even if the season is unfavorable, and the plants are strong and vigorous throughout the growing season. It is only from seed from such ears that a high yield can be secured.

GOOD SOIL FOR CORN.

What is soil?—The soil is a very interesting thing. It is not only a place to support plants to keep the wind from blowing them over, but it is also a great laboratory, a storehouse, a place where miracles are worked. The soil is a living thing. A good soil has a vast number of bacteria or living microörganisms in it. These bacteria make food for plants. However, if the pores of the soil are continually filled with water so air can not get through them, or if the soil does not contain organic matter such as decayed leaves or stable manure, etc., the bacteria can not exist and consequently can not prepare plant food. Now in order to produce a maximum yield of corn, it is necessary to have a soil well filled with humus or organic matter, and well drained.

Good corn soil.—The nature of the soil in which corn is to be planted has a great deal to do with the yield of ears. From the nature of its root system, corn is a plant that must have a deep,

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[1] The germ is on the side of the kernel toward the tip of the ear, so be careful not injure it when removing the kernels.

rather fertile loam, well filled with organic matter. As a rule bottom lands are best suited for corn growth, though very good crops have been produced on upland soil when such soil has received the proper fertilizers and has been well prepared. In the Philippines where we have a long rainy season a large amount of plant food in our soils is leached out each year, and unless manure or other fertilizer is added, we will get a poor yield of corn. It is a bad custom to plant corn on land low in plant food, and since our farmers as a general thing do not have enough money to buy commercial or chemical fertilizers, we must improve the fertility of our soil by adding stable manure or plant and plow under some crop like mungo or cowpeas. These two crops have small microörganisms on their roots which have the power of taking plant food from the air and of storing it in the soil for plant use. When these plants die, their roots with the plant food in them remain in the soil and make food for other plants that are later planted in the same soil.

Some soils not good for corn.—Certain plants adapt themselves to their environments, but this is not so with corn. A soil low in plant food may produce a small corn stalk, but no grain. On some farms there are large areas planted in corn, many portions of which will not produce a crop. These portions may be clayey spots, or swampy or undrained areas, or ground adjacent to timber. It is too great a waste of time and labor to cultivate such places. The clayey spots should be fertilized, the swampy areas drained, and the corn planted farther away from the timber if a good crop is to be raised.

In a great many cases a rearranging of fields will increase the yield of corn on many farms. This will make them more uniform as regards moisture and soil fertility. Very often there are wet places in fields when the remaining portions are dry enough to be cultivated, and when such wet places are plowed the mechanical condition of the soil is injured.

Preparation of the seedbed.—Land for corn should be plowed at least 20 centimeters deep with an implement that will not bring the subsoil to the surface. All trash and other waste material should be well covered by the breaking plow. A harrow should immediately follow the plow to pulverize all lumps of earth and to leave the soil smooth and level. Straight rows should be run at right angles to the slope of the field. These rows should be 1 meter apart and 7 centimeters deep. Seed corn from tested ears should be planted in hills 30 centimeters apart with one kernel in each hill.

CULTIVATION OF CORN.

Time to plant.—Where two crops of corn are grown each year, the first should be planted during May and June and the second in October and November. The first crop will be ready for harvest from the latter part of August to the first of October; the second, from February to March. In a great many localities in the Islands corn may be seen in almost any stage from planting to harvest at any time of the year.

Depth to plant.—The quality of the soil and the moisture content are very important things to consider when planting seed. If the soil is a stiff or heavy clay containing plenty of moisture at planting time, 3 centimeters is sufficiently deep; but if it is a light, open dry soil, 7 or 10 centimeters is better. Seven centimeters is a good average. If corn is planted deeper than 10 centimeters much of the food supply stored in the seed will be consumed before the young plant can reach the surface and expand its leaves. Planting the seed deeply does not send the roots deep into the soil.

Cultivation.—In studying the growth of corn, the roots should receive considerable attention because it is necessary to understand them in order to intelligently cultivate the growing crop. There is no taproot to corn, though the lateral roots are sometimes longer than the plant is tall. Roots from plants 30 centimeters high may lap across the rows, and unless shallow cultivation is practiced the crop will be ruined. Experiments have shown that while corn sends many of its roots 90 to 120 centimeters deep, the plant places the great body of its feeding roots from 7 to 25 centimeters below the surface where the soil is made loose enough by plowing to permit it. The roots send out in every direction an infinite number of hairlike growths, which absorb moisture and food. Corn is a surface feeder.

The surface of a corn field should be smooth and level and the cultivation should be frequent and shallow. Cultivate the ground deeply before planting, but afterwards the cultivation should be as shallow as possible.

Cultivation should begin immediately after the first rain that follows planting. There is no better implement for this work than a light smoothing harrow with slender teeth pointing backward. The corn should be hoed and thinned to the proper number of stalks when it is from 10 to 15 centimeters high, as it will then be past danger from bud worms, cutworms and other insects which often attack the young plants soon after they appear, but which seldom do any injury later in the season. At

the same time any weeds which may be growing in the rows between the stalks should be cut out. After the corn becomes too large for using a harrow, the best work can be done with a light side harrow, or with a cultivator having from five to seven teeth and running not more than 5 centimeters deep. The cultivation should be sufficiently frequent to keep down all weeds and to break the surface crust after every rain. In time of drought the cultivation should be as frequent as possible.

CARE OF SEED CORN.

After we have selected, tested, planted, cultivated and harvested our corn crop, the next thing to do is to preserve it until ready to be sold or planted again. It is very important that all corn which is to be used for seed should be preserved in the best manner possible. Though seed corn may be thoroughly dried, it will absorb moisture again when it comes in contact

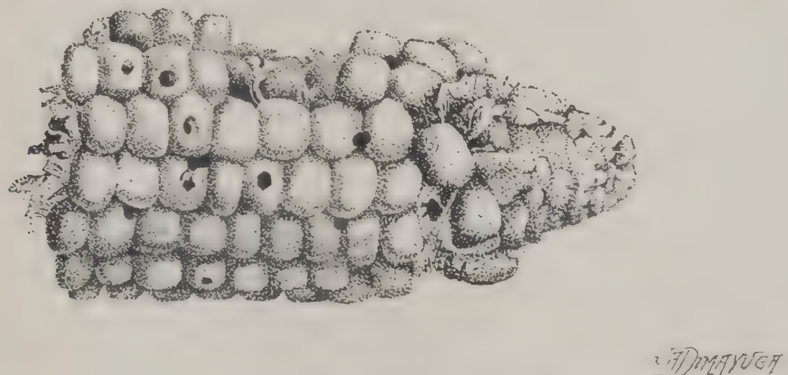

FIG. 5.—Corn Attacked by Weevils.

with a damp atmosphere. When first harvested, seed corn very often contains from 20 to 30 per cent of moisture, and unless it is well dried it may be ruined in a single day through heating.

At harvest time, when the ears of corn are ripe they should be taken from the stalks with the husks on and should be placed in a dry, well ventilated place where the ears can be spread out. The seed ears should be spread in the sun during the middle of the day for several days until they are thoroughly dry. Then the ears should be tied by the husks into bundles of ten or twelve. Be careful, however, not to take all of the husk off. These bundles should now be hung on the rafters in the ceiling of the planters' home where they will not get damp.

Weevils.—In the Philippines, as in all hot countries, stored grain is always damaged by weevils. These weevils are small insects having snouts which they use to bore into the kernel of corn for the starch and germ contained therein. Therefore in storing corn, it is very important that farmers guard against

the attack of weevils. These insects can be held in check by having the husks fit tightly over the ears and by planting varieties with hard kernels (flint corn); the only effective and

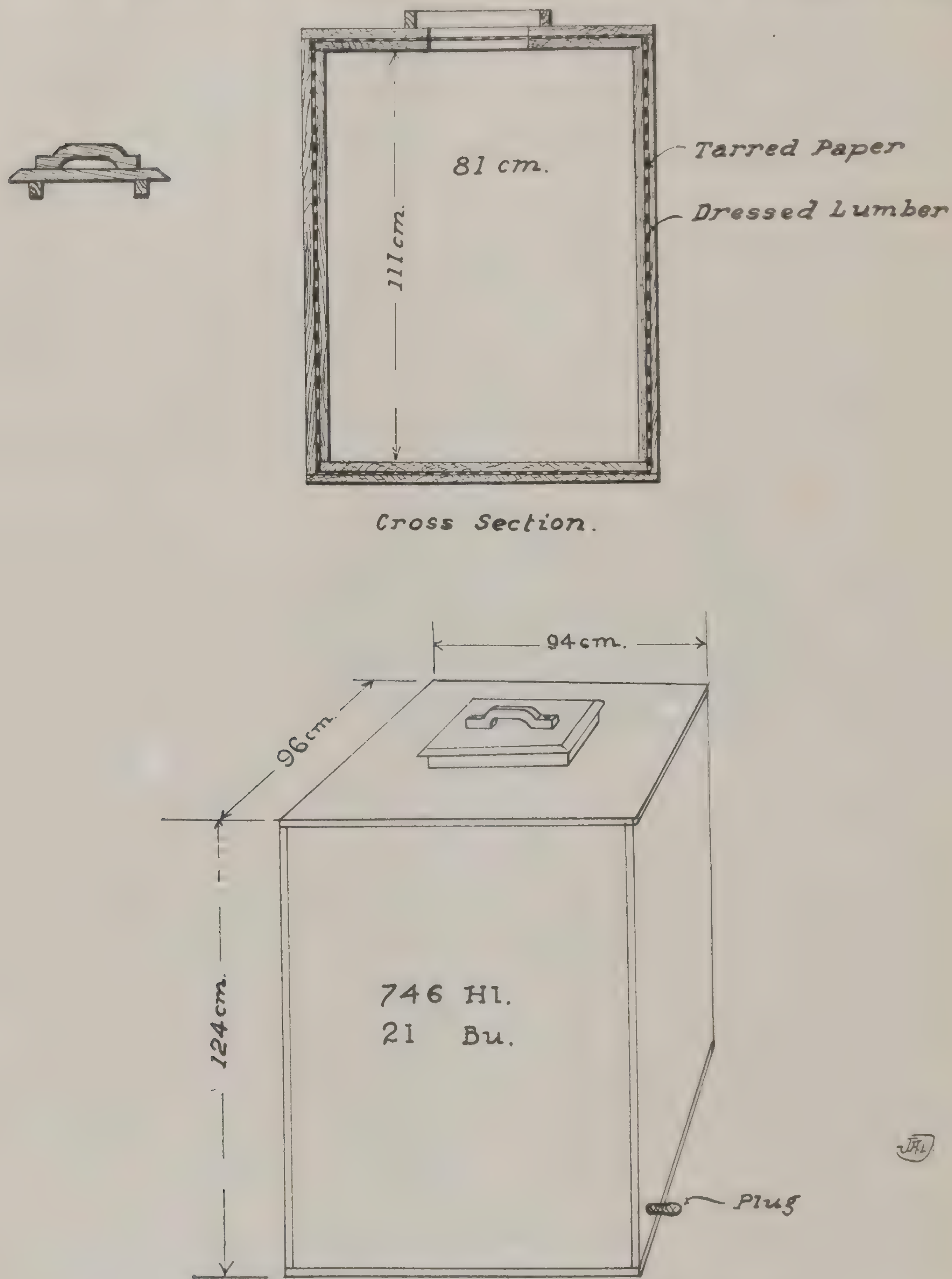

FIG. 6.—A Quarantine Bin for Bisulphide of Carbon Fumigation

simple method of eradicating them in stored corn, however, is by using carbon bisulphide, a colorless liquid with a strong, disagreeable odor which soon passes away. It evaporates very quickly, is highly inflammable, but is a powerful poison.

How to apply carbon bisulphide.—If the weevils attack your seed corn, get a deep box or tight barrel. Place the seed corn in this; bore a hole in the side near the bottom and plug this during fumigation, after which the plug should be removed for the gas to escape; put 31 grams of carbon bisulphide in a saucer or on a piece of cotton; place this on top of the corn and then cover the top of the box or barrel with a piece of burlap or canvas, leaving this covering on for six hours.

The carbon bisulphide rapidly volatilizes or turns to gas, and being heavier than air, it descends and permeates the mass of corn, killing all insects or other vermin present.

Carbon bisulphide retails in Manila for ₱2.86 a kilo.

Caution.—The vapor of carbon bisulphide is deadly to all animal life if inhaled in sufficient quantity, but there is no danger in inhaling a small amount. The vapor is very inflammable, and a lighted cigarette or cigar should not be brought in contact with it.

CORN AS FOOD FOR MAN.

There are a great many people in these Islands who think that corn is not "fit" for human consumption, but think it is good only for feeding horses, carabaos and pigs. This is a great mistake. Corn has been used for human food for many centuries. It was one of the chief articles of diet used by the American Indian, and was transmitted by him to the early immigrants who settled America. It has long been grown by the Arabs of northern and the Kafirs of southern Africa, and is a staple crop throughout most regions of the African continent, as well as in southern and central Asia, China and Australia. After the potato famine in 1847, an effort was made to introduce corn into Ireland and since that time a considerable amount has been grown and used for food in that country. To-day corn forms the main food for two-thirds of the rural population of Italy, Mexico, Central and South America and the West Indies and is a very valuable food crop in the Southern States of America.

In speaking of the food value of a certain product, we mean the ratio existing between the digestible protein and the carbohydrates and fats it contains. This is called the "nutritive ratio," and is obtained in the following manner: The amount of digestible fat or oil is multiplied by 2.25, because the fat or oil is considered as having this heat value compared with the carbohydrates. The product obtained is added to the total quantity of digestible carbohydrates.

To get the nutritive ratio of corn meal, the digestible nutrients in which, as given in the following table, are, protein 9.0, carbohydrates 61.2, and fat or oil 6.2, we proceed as follows:

Fat, 6.2 × meat equivalent, 2.25	13.95
Fat, 13.95 + carbohydrates, 61.2	75.15
Fat, 75.15 ÷ protein, 9.0	8.33

The nutritive ratio is 1: 8.33.

Nutrient value.

Product.	Protein.	Carbohydrates.	Fat or oil.	Authority.
Corn, germ meal	9.0	61.2	6.2	Henry.
Cleaned rice	8.00	79.0	0.3	United States Farmers' Bulletin No. 417.
Wheat flour	10.8	74.8	1.1	Do.

Therefore in expressing the nutritive ratio of corn meal thus, 1:8.33, it is meant that for each part of digestible protein in corn meal there are 8.33 parts of digestible carbohydrates and fat equivalent. In like manner the nutritive ratio for cleaned rice is found to be 1:9.96.

From this it will be seen that both corn meal and rice are carbonaceous foods, or foods that have a very much larger percentage of starch than protein. Now a food that contains both carbohydrates and protein in sufficient amounts, or having a nutritive ratio of 1:5 or 1:6, is called a balanced ration. Then neither corn nor rice are balanced rations. They are "medium" and to give the best results, a food having a large amount of digestible protein, such as lean meat, eggs or beans, should be eaten with them. Carbonaceous foods are fattening, while a protein food makes muscle and lean meat. They are concentrated foods and are highly nutritious. If the market value and the amount of nutrition in corn are considered, it is by far the cheapest food offered to mankind. Like rice, corn is a carbonaceous food, but unlike rice, it is rich in fat or oil and contains more protein. Compared with wheat, corn has somewhat less carbohydrates and protein, but more oil. The germ of the corn grain contains the oil, while the starch is found around and above the embryo.

As an article of diet, corn should be very popular in the Islands because it comes nearer being a balanced ration than rice and, too, corn can be eaten while the ears are young as well as when mature, while rice, it is said, should be at least three months harvested before it is used for food.

AN ATTEMPT TO IMPROVE THE QUALITY OF ABACA.

By M. M. Saleeby, *Chief, Fiber Division.*

The present condition of the abacá industry is very much complicated, and its improvement must necessarily require the coöperation of the three parties concerned—namely, the producers, the buyers, and the Government. Such coöperation is absolutely necessary, for at the present time all the phases of the industry are sorely neglected and the planters are in a condition a little better than one of utter despair. This is especially the case in Albay Province, where the problem is indeed so complicated as to require for its solution means and efforts beyond the reach and power of any single one of the parties concerned.

Upon the Government devolves the duty of teaching the producers the best methods relative to the cultivation of the plant and the best means for extracting and handling the fiber, thus enabling them to obtain a maximum yield both in the quantity and the value of the product. The chief difficulty encountered by the Government in carrying on its own work with the producers has been not so much the want of confidence by the latter in the methods suggested, as in their inability to practise them, owing to the lack of the necessary capital. This, of course, was in turn due to the inability of the producers to obtain just and reasonable prices commensurate with the grades they produced. The local buyers did not sufficiently discriminate in their prices between the high and the low grades of the fiber, and the general production of inferior grades followed as a natural consequence. Such is the present condition of the abacá industry in many of the principal abacá provinces, such as Albay, Camarines, Sorsogon, Leyte, and others.

It is plain, therefore, that the first step in the solution of the abacá problem is some kind of understanding or coöperation, first, among the intelligent class of producers in any province, and second, between them and the local buyers. The solution of this question will considerably facilitate the solution of the other problems, in which the Government is more directly concerned.

The above explains why this Bureau is watching with a great deal of interest the commendable efforts which the provincial governor of Albay is putting forth to bring about an understanding between the producers and buyers of abacá in his province, which is essential for the ultimate improvement in the general conditions of the abacá industry. It is reported that at his call two conventions were held at Ligao and Tabaco, in which both the producers and local buyers discussed at length the various measures that should be taken to restore the industry to its former condition of prosperity. It is also reported, though no details have as yet been received, that the results were very promising and that an understanding for the encouragement of the production of the higher grades of the fiber was arrived at. The efforts of the provincial governor, even though it will be sometime before they are completely materialized, constitute the best and most commendable service that a governor can render to his province, and we hope that the governors of the rest of the principal abacá provinces will take a similar interest and endeavor to improve the status of the industry in their own provinces.

Albay is the principal abacá province in the Philippines, and if the producers and buyers of the product are really actuated by a common desire to improve the condition of the abacá industry, their concerted action will have the influence and force of a law. The benefits to the province in general from such an understanding between the producers and the buyers will certainly justify any efforts that may have been put forth to bring about such an understanding. The exports of abacá from Albay during the calendar year 1911 were approximately 55,000 tons which, valued at ₱144 per ton, represented a revenue of about 8 million pesos. If the fiber had been more carefully cleaned and taken care of, the grade of the fiber should have averaged, at least, good current instead of superior seconds or fair current U. K., as is the general average there. Cleaning the fiber so as to average good current or over will necessarily reduce the quantity about 20 per cent, but will increase the value by 75 per cent or more. Thus if the quantity produced during the year 1911 had been so prepared as to average good current only, it would have amounted to 44,000 tons which, valued at ₱260 per ton, would have represented a revenue of about ₱11,500,000, or a net gain of ₱3,500,000. This increase, properly and judiciously spent, would go a long way towards improving the condition of the plantations and strengthening the economic standing of the producers in general.

THE SILO.

By CHAS. M. CONNER, *Chief, Division of Agronomy.*

The Bureau of Agriculture has just completed and filled a circular cement silo at the Alabang stock farm, which is the first cement silo in the Far East. It is 5 meters in diameter and $8\frac{1}{2}$ meters high and has a capacity of 100 tons.

While silos are not as essential in feeding dairy cattle in this climate as they are in those sections having long winters, yet there are times during the dry season when there is a scarcity of green fodder. It also happens that we can grow sorghum and corn much cheaper during certain seasons than during others, and this sorghum or corn may be preserved in the silo and fed during the dry season, at a cost much less than that at which green fodder can be purchased during such times of scarcity.

A silo is merely a building having air-tight walls for the purpose of preserving green fodder by the heat resulting from fermentation. Green fodder thus preserved is called ensilage or silage. The same result may be obtained by digging a pit in the ground, but in a country like this where there is an excessive rainfall, such a practice is not advisable.

In India a fairly successful silo has been built of split bamboo woven together in the form of a large basket about $2\frac{1}{2}$ meters in diameter with perpendicular sides 5 meters high, then made air-tight by plastering with mud. A good cheap silo, any size desired, may be constructed by nailing expanded metal to upright pieces of two by four and plastering this with cement.

The cylindrical form of the silo is now most used. Aside from the fact that this form has less surface exposed than a rectangular structure of the same capacity, it can be built with the least amount of lumber. A high and narrow silo is preferable to one low and broad, because in the high silo the weight of the upper part of the column helps to drive the air out from the lower part. In adjusting the size of the silo to the

herd, the diameter should be increased or decreased and not the height. The usual plan is to have the silo extend about 8 or 10 meters above the ground and 1½ to 2 meters below the surface, depending upon the slope of the ground and the drainage.

The only reason for limiting the height to 10 meters is the fact that blowers and carriers for elevating the material over the top of the silo do not work well for greater heights. The silo may have any diameter from 2 to 8 meters. Cement should be used for making the foundation in order to prevent surface water from entering the pit and spoiling the silage.

There are two absolute essentials to the success of the silo: Its walls must be perpendicular and smooth because the loose material will settle as much as 2 meters during the first two or three days and if the walls are not perpendicular and smooth there will be spaces left between the material and the walls which will allow the air to enter and spoil the silage; the walls must be air-tight for the same reason. Close-fitting doors 50 by 60 centimeters should be placed one above the other, 2 meters apart, for the purpose of taking out the silage. The silo is filled from the top but the doors should be left out as long as possible in order to give ventilation while the men are spreading and packing the material.

The cost of the silo will depend upon the kind constructed. A one-hundred-ton silo may be constructed of wood and plastered at a cost of three pesos for each ton of capacity. One of reinforced cement, having walls 10 centimeters thick will cost about ten pesos per ton of capacity. For a smaller silo the cost increases slightly, and decreases for one of larger capacity.

In the Tropics silage will spoil if exposed to the air more than twenty-four hours; it is therefore essential that the diameter of the silo be governed by the number of cattle to be fed. A layer at least 5 centimeters in depth should be taken off each day so that a perfectly fresh surface will be exposed. A silo 5 by 8½ meters will hold sufficient feed to furnish 15 kilos per day per animal (one day's ration) to fifty animals for one hundred and thirty-five days. One cubic meter will weigh approximately 650 kilos.

Green feed preserved in the silo is not bettered in any way except that some materials may be improved in palatability. The gain is in being able to secure the feed when abundant and cheap, and keep it until there is a scarcity.

PLATE II.—MORGAN STALLION "DUKE OF ALBANY," BUREAU OF AGRICULTURE BREEDING STATION, VIRAC, CATANDUANES.

Any green fodder that is nutritious may be used for filling the silo provided it does not have a hollow stem like rice. The hollow stem will retain so much air that it will cause the material to spoil.

If such crops as mungos, cow peas, velvet beans or beggarweed can be mixed with the corn or sorghum, a nearly balanced ration for dairy cattle or work animals will result.

Sugar-cane tops would also make good silage provided something less sweet were mixed with them. The fermentation which goes on results in the formation of more or less acid, depending upon the materials used. Sorghum or sugar cane alone would make rather sour silage.

The corn, sorghum, or whatever material is used for filling the silo, should be cut at the stage of growth when it contains the greatest amount of digestible matter; for example, corn should be cut after it has passed out of the milk stage, and sorghum should be cut as soon as the heads turn dark or show signs of ripening. Just here may be mentioned another of the advantages of the silo: much more digestible matter may be obtained from a hectare of corn or sorghum by cutting and preserving in the silo than by cutting and feeding from the field. If handled in the latter way much of it must, of necessity, be cut too young when it is watery and really not fit for feeding, or it must be allowed to stand until it is overripe and has become dry and woody.

If it should happen that a drought has caused the crop to dry up and have many dry or dead leaves on the stems, the material should be dampened as it is put into the silo in order to prevent dry rot. Just how much water to use must be determined by practice. Rain need not stop the filling process as an excess of water would do little damage as compared with not enough. It is essential that the material be well packed next to the wall as the silo is being filled. This may be done by a man walking around keeping one foot close to the wall.

In order to fill a silo properly it is necessary to have a cutter with a blower attached for the purpose of elevating the material into the silo. The corn, or whatever else is being used, should be cut into pieces about 2 centimeters in length.

A cutter for a silo 5 by 8 meters would cost about ₱200 and would require about an eight-horsepower engine to run.

The cost of filling will vary with the distance the material has to be hauled and the kind of the material used. The cost of filling the one at Alabang with sorghum was ₱1.87 per ton

for cutting, hauling, and putting through the cutter into the silo. The average haul was 1 kilometer.

When once the filling has been started, it is necessary to continue until finished. A stop of one day may be made without danger of loss but in case it is necessary to stop for several days or a week, the decayed stuff should be thrown off the top before any new material is put in. When the silo has been finally filled it should be well packed on the top and wet down so as to induce the surface to start decaying. This, in a measure, seals up the top. Never allow this cover to be broken until you are ready to commence feeding.

Silage alone may be fed to animals doing no work, but animals at hard work should have a grain ration in addition. As it does not differ in composition in any essential points from the material before it was put in the silo the animals may be given all they will eat of it.

Cattle do not eat silage readily at the first feeding, but after a few trials they become very fond of it. It is for this reason that the silo is most used by dairymen where the cows are kept for years. It would not be profitable to men who feed beef cattle for a few weeks only.

SECOND ANNUAL CATANDUANES LIVE-STOCK AND AGRICULTURAL FAIR.

By C. W. EDWARDS, *Husbandman.*

One of the most convincing evidences of the interest and coöperation that the people of the Islands of Catanduanes are according the general work of improvement of animal husbandry and agricultural conditions, which is being carried on in the Island by the Bureau of Agriculture, is their annual live-stock and agricultural exposition, inaugurated last year. The second exhibit was held at Virac, July 4 to 7 inclusive, and the many entries presented, large number of people in attendance and general enthusiasm, gave strong indication of the success and permanency of this institution. Fairs of this nature are very potent factors in the great work of upbuilding the general agricultural and live-stock conditions of a country and in this movement Catanduanes has set an example which may well be followed by other provinces. In this connection a brief outline of the original plan of organization may be of interest:

A central committee of five members—the initial organization having been appointed by the Lieutenant-Governor—is given charge of the work of preparing and conducting the exhibit for the ensuing year, and at the conclusion of the event they in turn appoint their successors for the year following. It is the duty of these members to appoint representatives in each municipality who shall choose subcommittees in each barrio of their respective districts. The main duties of the members of the subcommittee are to keep the people informed as to the general plans and progress of the exhibit, to create enthusiasm and aid in securing entries. A queen of the exposition and ladies in waiting are elected by public ballot. Votes are sold for various candidates at one centavo each and the proceeds thus obtained are utilized in the defraying of incidental expenses and in paying cash premiums for the various classes entered at the exhibit. The initial work of organization entailed the securing of a suit-

able site for the exposition grounds, clearing of the land, erection of necessary buildings, etc. In this work various municipalities and barrios donated materials while others furnished laborers. The site was given by the town of Virac.

The same general plans as outlined above were followed in the work of the 1912 exposition.

A number of Manila merchants and firms added a great deal to the interest and success of this year's exposition by very generously granting a number of premiums. The following is a list of these donators with the respective contributions:

Pickett Harness Co., one fancy carromata harness, one MacClellan saddle blanket and bridle.

M. A. Clark Co., 50 kilos candy, 68 cans coffee.

Germinal Cigar and Cigarette Factory, 420 cigars, 200 packages of cigarettes.

The San Francisco, one handbag.

American Hardware and Plumbing Co., one patent wire gate.

Squires-Bingham Co., one mirror.

"La Badenia," Inc., Cigar Factory, cigars and cigarettes.

Smith, Bell & Co., Ltd., ₱25 in cash.

The members of the central committee were as follows: Eustaquio Joson, president; Valentin Francisco, treasurer; Alipio Arcilla, secretary.

Municipal representatives chosen by the central committee were: Eusebio Reyes, Virac; Pedro Chaves, Bato; Braulio Tafula, Calolbon; José de Vera, Pandan; Aurelio Arcilla, Baras.

Miss María de Vera of Pandan was the popular choice for queen and the Misses Carmen Arcilla of Virac and María Abalda of Calolbon were chosen as ladies in waiting.

The official opening occurred on the morning of July 4. The beautifully decorated carriage of the queen and her ladies, and their mounted escort, headed the civic parade which formed on the municipal plaza and marched to the exposition grounds. The Independence Day oration was delivered by Assemblyman Silvino Brimbuela, which was followed by an address dealing with the exposition, its importance to the Island, its aims, future, etc., by the newly elect third member of the provincial board, Sr. Timoteo Alcala.

The various classes of animals and agricultural products were very well represented. There was an especially large number of horses presented, in several classes the entries numbering as high as thirty-five animals. The most interesting and significant exhibit in this department was the mares with mestizo

colts the get of the Bureau sires now located at the breeding stations on the Island. This class presented to the people concrete examples of the beneficial results obtained from crossing the native stock with animals of superior breeding and such convincing demonstrations can only result in a more willing and earnest coöperation in the work of upgrading the native live stock.

The exposition proper terminated July 6 and on the following morning a happy conclusion of this successful exhibit was the gathering of the people on the town plaza to listen an address by the queen and to witness the distribution of the premiums.

The officials and people in general of Catanduanes deserve much credit for the success attained thus far in this line of endeavor, as events of this character have a deeper significance than simply an exhibition of the country's products. They are indications of a progressive movement resulting in permanent general improvement, better crops, better live stock, more and better food and clothing, higher education, and a higher standard of living.

CURRENT NOTES[1]—OCTOBER.

THE CORN CROP.

The corn crop which was harvested the past month was perhaps the largest that has been harvested for a corresponding period in many years. The reason for this, of course, was the short rice crop.

In passing through the fields one is struck with the closeness of planting and the lack of cultivation. The yield could have been made much larger if the rows had been given sufficient width and the crop properly cultivated. Most planters seem to think that corn should be planted like rice, i. e., thick enough to keep down the weeds. Corn so planted will give a heavy yield of fodder but little grain. The maximum amount of grain is produced when the individual plants are given plenty of room. The rows should be not less than 75 centimeters apart and the stalks 25 centimeters apart in the row. The crop should be cultivated about five times during the season.

It is possible to grow three crops of corn each year but two of these will be light. The heaviest yield can be obtained by planting in February.

The following yields were obtained with Mexican June planted at Singalong:

Planted, June 23; harvested, September 30; yield, 1,300 kilos per hectare.

Planted, October 15; harvested January 23; yield, 1,858 kilos per hectare.

Planted, February 3; harvested May 31; yield, 2,840 kilos per hectare.

It should be mentioned here that irrigation water ought to be available for the dry season. (*C. M. Conner.*)

ANOTHER NEW BRANCH OF ANIMAL INDUSTRY.

Notwithstanding the vast increase in imports of alligator skins in New York during the past few years, prices still con-

[1] Original notes prepared by various members of the Bureau of Agriculture.

tinue high. A good skin from 2 meters to 3 meters in length is now worth about ₱3 delivered in New York. One firm in Newark, New Jersey, controls the bulk of the trade which now amounts to probably some 50,000 to 75,000 skins per year. These skins come from Colombia and Venezuela where they are collected by native Indians who slaughter the animals by crude methods. Rifles are seldom used, the hunters finding it much cheaper to spear the reptiles in shallow creeks and ponds in the dry season; after the spears have weakened the alligators, they are hauled out upon the bank and beheaded with a long-handled (sic) ax. Very probably traps or inclosures made of wire-fencing material could be used to corral large numbers of the reptiles and thus cheapen the cost of collection. In fact, it is said that nets made of stout wire have been used successfully in catching the smaller whales.

It is a question, however, whether this industry would ever pay on a large scale in the Philippines. There is no doubt but that certain lakes, such as Lake Nauhan in Mindoro, and some of the rivers and lakes in Mindanao, would furnish plenty of business for the "caiman" or "buwaya" hunter.

In this connection it must be remembered that there are several kinds of crocodiles and alligators; those which have the thick osseous deposits in the skin are not of much value to the tanner; a pliable, "green-salted" hide with no bone-plates makes the best article. (*O. W. Barrett.*)

HORSES IN DENMARK.

Though comprising only about one-eighth the area of the Philippine Archipelago, the little country of Denmark boasts of possessing 550,000 horses, whereas in the vast area of the Philippine Archipelago less than 250,000 horses exist. By the way, the daily ration of the huge Jutland horse of Denmark is about 7 kilos of oats, $2\frac{1}{2}$ kilos of maize, 1 kilo of molasses, 3 kilos of hay and $1\frac{1}{2}$ kilos of straw; this allowance would last the average Philippine pony nearly one week. (*O. W. Barrett.*)

SOYA SOAP.

The vast area planted with "Manchurian beans" in northeastern China and the contiguous portion of Siberia may in the near future be greater still. A new field for bean oil has been found and the new factories in Mukden and Dalny are now turning out very large amounts of both laundry and toilet soaps.

It is understood that the Lever Bros. Ltd., of Port Sunlight, England, will also establish a monster soap factory at Kobe; the only drawback thus far is the lack of alkali in Japan and northern China. According to the Bureau of Manufactures of the United States Department of Commerce and Labor, the United States uses considerably over ₱5,000,000 worth of bean oil annually.

Soya oil affects the price of copra. Soya soap relieves the overproduction tendency of bean oil and thus becomes a long-distance enemy of the Philippine coconut, although it directly assists in a degree in keeping up the price of soya oil. (*O. W. Barrett.*)

AMERICA'S HEAVY SEED IMPORTATIONS.

Although the United States produces most of its own seeds, both vegetable and grain, there are also in evidence very costly importations from abroad. For instance, it takes over 1,000 tons of caraway seed, over 500 tons of anise, and over 500 tons of coriander for flavoring various beverages, confections, etc. Most of these seeds can be produced more cheaply in Europe than in the United States. In addition to the great quantity of home-grown sugar-beet seed, some 5,500 tons are imported from Europe. It is a matter for considerable doubt whether all the canary birds and their caged cousins in the United States can consume the 3,000 tons of canary seed brought over from Europe every year—or whether a part of this huge pile finds its way into other channels. (*O. W. Barrett.*)

FORMOSAN RAILWAYS.

A railway which will out-Baguio our line to the summer capital is being constructed from Kagi to near the top of Mount Ari, 2,300 meters above sea level. This short road of only 65 kilometers is well provided with 70 bridges and 73 tunnels. The scenery from this new line, it is claimed, will rival that of any other road in the Orient. The railway, however, is not for the pleasure of the tourist, although the views looking down upon the clouds and tropical jungles and gorges of the interior will be exceedingly fine; this road is really a timber-hauling concern. Not only the red cypress and cedar-like timber trees, some of which are two thousand years old with a circumference of some 20 meters at the base, but also oaks and other high-grade woods will be brought down by American locomotives to a genuine Milwaukee sawmill at Kagi. (*O. W. Barrett.*)

HAWAIIAN COFFEE.

Hawaii has been struggling bravely with her coffee proposition for some time and now it appears a trial order has been placed by the Commissary-General of the War Department at Washington for some 17 tons of Hawaiian coffee for use in the United States Army here in the Philippines. (*O. W. Barrett.*)

LIVE-STOCK INDUSTRY OF ERITREA.

Italy now needs a better meat supply and, with this end in view, is endeavoring to develop the cattle, sheep, and goat production of the Italian colony on the Red Sea. The cattle men of the Philippines will be interested to learn that the Italian Government has instituted a "tax for vaccination of live stock" in Eritrea and an expert from the Italian Vaccine Institute is now on the ground enforcing the new regulations. If all goes well, the fertile plains and valleys of the hinterland of Eritrea will soon be producing a large proportion of the over-sea meat supply of Italy.

This colony may in the near future become famous for its excellent horses, of which there are now only some thirty thousand head. A superior race of dromedaries is also raised in that country; there are some 50,000 of these animals according to the last census. The three hundred thousand head of meat cattle will be rapidly increased.

Though in size only a very small colony as compared with Benadir, or Italian Somaliland, Eritrea has a population of about half a million—probably more than that of all Benadir, which exceeds the Philippines in area. (*O. W. Barrett.*)

A NEW USE FOR CHICLE.

Some 3,000 tons of chicle are annually imported into the United States for chewing gum. Practically all of the supply comes from Mexico and Central America. In Peru, however, where a fair amount of this gum can be produced, a sort of waterproof varnish is prepared for treating the so-called Panamá hats to give them the proper creamy shade and brilliancy.

Hence the Philippine chico has another use ahead of it, even if it never helps furnish the 10-tons-per-day gum supply. (*O. W. Barrett.*)

RUBBER AND DROUGHT.

The prolonged drought throughout the Far East has undoubtedly done a very large amount of damage to the rubber plantations especially to those not yet of tapable age. While the trees

are struggling against death from thirst, it is manifestly unwise for planters to reduce their vitality still further by tapping them; and the young trees whose root systems are still close to the sunbaked surface of the soil must needs become pretty badly "set back" or stunted—an effect which may persist for several years.

This drought has surprised even the old residents not only of East Africa but away around into Tropical America. It is stated that the Orinoco has been the lowest on record during the past season; it is interesting to note, however, in this connection that the shortage of water in that river is partly due to a larger channel which the famous "connecting link" river, the Cassiquiare, has made for itself from the upper portion of the Orinoco backward into the Rio Negro, a tributary of the Amazon.

This difficulty of water transportation of the Orinoco has affected the production of balatá; since nearly all of the world's supply of this article comes from the Orinoco Basin, the price of Mindanao guttapercha should feel a slight increase.

Over in the Federated Malay States the drought has affected rubber so much more than coconuts that a rather rash comment has inadvertently come to notice, to the effect that "coconuts are better than rubber these days." (*O. W. Barrett.*)

ARTIFICIAL SILK.

Silk has another new rival besides "vegetable casein," spun wood, and cotton silk—a new kind of *spun glass.* The glass fibers, while of course liable to wear out in time, are proof against mildew, acids, etc. The new glass fiber, which is about one-eighteenth the diameter of a hair," gives a perfectly pliable, brilliant, and strong fiber which resembles silk in appearance; it can, of course, be colored to "suit the taste."

This new glass silk costs only 50 to 60 centavos per kilo and may become a serious rival of caterpillar silk—if we must now be so specific in speaking of the real article.

About 32,000 tons of the genuine article are now produced annually. By the way, how many million tons of the humble and seldom-mentioned mulberry-leaf does this represent? (*O. W. Barrett.*)

A NEW RIVAL OF KAPOK.

"Crin végétal" is a comparatively new vegetable fiber made from the leaves of North African palmettos. It is used principally in stuffing furniture, mattresses, etc., and while very much coarser than kapok, it is obtainable from the natives, who

work at gathering this product during the slack season, at ₱0.80 per hundred kilos. The middleman, of course, makes a good profit, but even at the Hamburg price of ₱30 per ton, kapok may find a serious rival. (*O. W. Barrett.*)

SOYA BEANS IN ARGENTINA.

The soya has just found a new field in what will probably be one of the best agricultural regions for the culture of that famous legume in the whole world. Instead of flax, which has heretofore been grown for linseed in rotation with wheat and maiz, the soya will now be used in Argentina both for its own oil and as a soil restorer, thus increasing the fertility of the fields.

While the percentage of oil in ordinary soya runs from 16 to 20 per cent, some of the new varieties which will be planted in the alluvial plains of the Plate River will contain up to 23 per cent. (*O. W. Barrett.*)

TRANSPLANTING EARLY RICE.

In transplanting early rice the people near Calauan, Laguna Province, save from twenty to twenty-five days, by sowing the seed rice on banana leaves in the following manner: the seedbed is prepared in the usual way by puddling the ground thoroughly, then laying the banana leaves over the surface and sinking them until just enough mud runs in upon the leaves to cover the seed which is to be planted. The seed of some early variety is soaked for thirty-six hours in water in order to hasten the sprouting. The seed is then spread over the banana leaves about 1 centimeter deep. In twelve or fifteen days, the young plants are about 8 or 10 centimeters high and have formed a thick mat over the banana leaves. As the young plants cannot take deep root on account of the banana leaves, the plants may be easily separated without breaking the tender roots. Rice may be transplanted in this way at twelve or fifteen days of age, whereas if planted in the regular way the plants must be thirty or forty days old or the tender roots will be broken off in pulling the plants from the seedbed and many of the plants will not survive when transplanted to the field, resulting in an imperfect stand. (*C. M. Conner.*)

THE WORLD'S POTASH HUNGER.

Germany has heretofore held the purse strings, so to speak, of the world's supply of that necessary plant-food, potash. The profits from the "kali" mines in that country have been enormous; the business has amounted to almost absolute monopoly.

Realizing, however, that there must be a limit in time to the supply from those mines, the Ministry of Finance of Baden has been making explorations for new sources of this valuable fertilizer with the result that a new deposit some 4 meters in thickness has been discovered, though at the rather inconvenient depth of over 700 meters.

The United States Department of Agriculture some time ago made a special appropriation for the search for new sources of potash for that country. While several rather limited deposits of potash minerals have been located in the Western States, great interest is now attaching to the discovery of a method for obtaining potash direct from seaweed. This substance has long been used in a more or less haphazard way for mulching in orchards near the seacoast and sometimes for its ash to be used as a direct fertilizer. It now seems that the matter will be taken up on a large scale and that potash factories will be erected at suitable locations along the Pacific Coast, with steam trawls for collecting the raw material.

The present price of sulphate of potash in Manila is about ₱150 per ton. (*O. W. Barrett.*)

LARGE COPRA DRYERS.

In the July, 1912, number of the REVIEW mention was made of a new type of apparatus for drying copra on a large scale. The idea, not to say invention, seems to have originated with Mr. Hamel Smith, the editor of Tropical Life, who has had considerable practical experience in the handling of tropical produce.

It seems that the new "drying-by-the-acre" method of Mr. Smith is receiving considerable attention in the Federated Malay States and it is probable that within a few years that country will take up generally this method for handling its copra.

The system is exceedingly simple and the whole matter is one which must win the favor of every firm or dealer who desires to improve the quality of the product. Theoretically a strong current of air will dry raw copra in proportion to the degree of heat and the speed of the air current—i. e., in from ten, say, to twenty-four hours. Mr. Smith's idea is to force strong currents of air into a comparatively large drying house containing several skeleton floors upon which the "meat" is spread. The air is, of course, heated over and around large furnaces using husks and shells as fuel. Since the temperature in such a drying house would be comparatively low, it ought to

meet with favor from the Ceylon producers who, it appears from articles in recent numbers of the Tropical Agriculturist, are becoming afraid of high temperatures in drying copra; they profess to believe that any temperature high enough to dry raw product in a few hours will "volatilize the oil" content of the raw material. By the way, there is, of course, a grain of sense in this fear; certain oils could be very quickly volatilized even without heat; but *coconut oil does not* belong in that class.

From the number of enquiries concerning copra dryers which have come to the notice of this Bureau recently, it is believed that the day when the middleman will be forced to recognize monetarily the difference between aromatically fragrant, perfectly dried, clean copra and the stinking half-rotten material (in which all sorts of fungi and bacteria are consuming the oil substance and thus greatly reducing the *real* value of the product) will come soon. (*O. W. Barrett.*)

CASSIA.

The world's supply of the old but still important spice-drug known as cassia, or Chinese cinnamon, comes to commerce both through Hongkong and Saigon. For some unknown reason there has been a great increase in shipments of the oil, as well as the "cassia-lignea" bark, during the past year. This oil and bark is used for the same purposes as Ceylon cinnamon, though being, of course, of inferior quality. Recent political disturbances and financial exigencies in China possibly account for the temporary fall in the export price.

The value of false cinnamon shipments, including oil, to the United States, is now considered to be about a million pesos per annum.

A few species of wild cinnamon trees occur in the forests of the Philippines. (*O. W. Barrett.*)

SHEA BUTTER AND OTHERS.

This commodity of the central section of the West Coast of Africa has been for many years a rather important item and although it does not at present enter largely into foreign commerce, it is probably only a question of a few years when the rapidly improving transportation conditions there will permit of this product's coming within reach of European markets. This vegetable tallow is prepared from the seeds of a large tree, *Butyrospermum parkii.* This tree and a cousin species, *Pentadesma butyracea,* which produces the kanya butter of Sierra

Leone, are represented in India by the famous Mahwa, *Bassia latifolia;* this produces vast quantities of dried flowers which are used in the making of alcoholic liquors; the oily seeds, too, yield a greenish, lard-like butter. The Shea butter of West Africa is used in cooking, as an illuminating oil, and as a sort of unguent panacea.

The Baro-Kano Railroad will open up an entirely new and large field for this product which was formerly confined largely to the waterways for transportation. The exports in Nigeria were only 2,000 tons in 1906, but in 1909 they had increased to 9,000 tons, and besides this amount 150 tons of the pure butter were exported in 1910; these figures will probably be trebled within one year.

The Shea tree, it should be remembered, does not exist in the area occupied by the West African Oil Palm—the great rival in that continent of the coconut.

By the way, coconut butter (*sensu lato*) is more important to-day than all the twelve or more other so-called vegetable "butters" combined.

And what *is* a butter? Strictly and entymologically speaking, butter is *ox cheese:* another dire example of the nerve-racking strain to which most of our good old English words have been put in the last few centuries. But, by the way again, isn't it about time that we had a word to indicate the kine species as an entity, one as unhampered by sex ideas as horse, pig, sheep, goat, etc.? "Ox" will not serve the purpose, at least not in America; "Bos" would answer nicely; in fact we have it already, but only cattlemen and zoölogists will use it. (*O. W. Barrett.*)

a

MOUNTAIN ROAD TO BUKIDNON. TAGOLOAN, MISAMIS, TO THE RIGHT, MACAJALAR BAY IN THE BACKGROUND.

b

CANYON PLANTED TO MANILA HEMP AND CACAO, TANKULAN, BUKIDNON.

PLATE I.

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CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

THE COTABATO VALLEY.

By the DIRECTOR OF AGRICULTURE.

The Cotabato Valley has been written up in the PHILIPPINE AGRICULTURAL REVIEW heretofore, but some mention of it may properly be made at this time by reason of the fact that the

eyes of the public are turned in that direction as one of the places in the Archipelago where rice might be grown to make good, at least in part, the amount which is imported from abroad.

Few people even in the Philippines appreciate the great areas of land well adapted to one or another of the various agricultural crops which are still entirely unused.

Along the Cotabato River as far as Fort Pikit, and by report much further, there are thousands of hectares of land of the highest fertility in the same virgin condition that it has been for ages. The Moros have small settlements occasionally, and a narrow ribbon of the land immediately fronting on the river is cultivated in a very primitive way, but the amount in use is negligible.

With regard to its adaptability to rice cultivation there seems to be no doubt, but experiments must be carried on, and studies made, in order to learn whether or not irrigation is needed, and for the settling of many other questions.

There can be no doubt, however, that the Cotabato Valley is extremely rich, and that the area is sufficient to furnish a food supply for many thousands of mouths.

HORTICULTURAL EXPLORATIONS IN MINDANAO AND IMPRESSIONS OF BUKIDNON AND BUTUAN.

By P. J. WESTER, *Horticulturist.*

In making one of his annual trips of inspection during the summer of 1912 of the Provinces of Mindanao under his jurisdiction, the Hon. Dean C. Worcester, Secretary of the Interior of the Government of the Philippine Islands, invited the Director of Agriculture, Mr. F. W. Taylor, to send with him representatives of the Bureau to make observations and study the places visited from the viewpoint of their respective fields of work.

The writer was directed by Mr. Taylor to accompany Mr. Worcester on this trip representing the division of horticulture. Arrangements had been made to join Mr. Worcester in Iloilo when information was received that the Insular Coast Guard *Polillo,* carrying Mr. Worcester and party, had been disabled in Cuyo, and the writer, together with Dr. F. C. Gearhart, chief of the division of animal husbandry, therefore proceeded direct to Cuyo on the Insular Coast Guard *Basilan,* which was ordered to take the place of the *Polillo.*

The *Basilan* left Manila July 26 and arrived at Cuyo the 28th, where the writer and Dr. Gearhart joined Mr. Worcester, Col. J. G. Harbord, Acting Director of the Philippine Constabulary, Sr. Manuel de Iriarte, Second Assistant Executive Secretary, Messrs. W. C. Bryant, governor of Agusan Province, F. Lewis, superintendent of exchanges Mountain Province and former governor of Agusan, J. R. Arnold, Executive Bureau, Frederick Worcester, and F. W. Sweitzer, stenographer.

From Cuyo the party proceeded to Calusa Island, where a short stop was made, and from there to Iloilo, where we were joined by Dr. W. S. Sherfesee, Acting Director of Forestry. Thereafter the itinerary included Siquijor, Siquijor; Butuan, Agusan; and Agusan, Misamis; from here we visited Tankulan, Maluco, and Sumilao in Bukidnon; at this place the writer left the rest of the party and returning to Agusan, explored Cagayan, Tagoloan, Villa Nueva, Talisayan, Alubijid, and Opol, Misamis.

Colonel Harbord returned to Manila. The remainder of the party returned from Bukidnon to Tagoloan August 10. Short stops were made at Jassan and Balingasag, Misamis, and the better part of a day was spent in Zamboanga and vicinity. Olutanga, Sarangani, Davao, Piso, Mati, and Baganga, Davao; Surigao, Surigao, and Butuan, Agusan, were next included in the itinerary. Messrs. Sherfesee, Bryant, and Mr. Stadtmiller of the Bureau of Forestry, who had joined the party in Zamboanga, made the trip overland from Davao, Moro Province, to Veruela, Agusan. The rest of the party proceeded up the Agusan River and its tributaries from Butuan in several small launches and the overland party joined them at Talacogon. Numerous towns were visited in the interior of Butuan, among others San Vicente, Amparo, Las Nieves, Esperanza, Sagunto, Bunauan, Loreto, and Veruela; the party arrived at Butuan again August 29 and returned to Manila September 2. While the weather at sea was frequently rough and unpleasant, the overland trips and stops were almost always accompanied by favorable weather, which greatly assisted in making the excursion a pleasurable one and facilitated the work performed.

During the trip the writer obtained living plant material of seventeen varieties of bananas, including Angao, Amas, Banegas, Bangaan, Binaoy, Binangay, Canton, Dool, Daliao, Inambac, Kadisnon, Kanala, Kilanpilan, Longsing, Masecampo, Sinañgil, and Tumbaga; Baúno (*Mangifera verticillata* Robinson) and Juany (*M. odorata* Griff.), two fruits related to the mango; Marang (*Artocarpus odoratissima* Blanco) and Togop (*Artocarpus elastica* Reinw.), two fruits related to the breadfruit; Kambog (*Dillenia speciosa* Gilg.), Libas (*Garcinia vidalii* Merrill), Durian (*Durio zibethinus* Lam.), Kayam (*Inocarpus edulis* Forst.); "Romano," an early fruiting variety of the coconut, Macopa (*Eugenia malaccensis* L.), and the sago palm (*Metroxylon rumphii* Mart.). Budwood was obtained of nine types of citrus fruits new to the writer, cuttings of *Vanilla philippinensis* Rolfe and one unidentified species of *Vanilla,* seeds of a *Phaseolus,* said to be very productive and the beans equal in quality to the Lima bean, two unidentified grasses, and two legumes that may prove valuable for forage. Material of over thirty species of new ornamental plants was also brought to Manila. The fruits collected on this trip, excepting the banana varieties and the citrus fruits, are discussed in a separate paper in the REVIEW.

The writer wishes to acknowledge his indebtedness to Mr. Worcester for the many thoughtful courtesies extended during the

trip which enabled him to secure much plant material that otherwise would have been unobtainable. The identifications have been made by Mr. E. D. Merrill, botanist, Bureau of Science. Unfortunately, the stops in many places were of too short duration to allow more than a few observations; however, these will be useful in the event of another collection trip to Mindanao.

The short stop made at Siquijor, the small island south of Negros, permitted little to be accomplished. A large date palm (*Phoenix dactylifera* L.), at least twenty-five years old and in excellent condition, growing in the convent garden, was an object of great interest, and to all who have contended that the date will not grow in the Philippines this palm furnishes excellent proof of the contrary. (Plate III, *a*.) A grape vine (*Vitis vinifera* L.) was another interesting plant noted in the convent garden, which, according to Mr. Worcester, was in bearing already in 1888 when he first visited Siquijor. This is the same variety that is found in Cebu and several other places in the Archipelago. Several large and thrifty vines of this grape were noted in Cagayan, Misamis, Agusan, Misamis, and Tagoloan, Misamis. The fruit is not the very best, but its vigor and health are all that can be desired and encourage the introduction into the Philippines of other grape varieties of better quality. Budwood of a hitherto unknown type of lemon was obtained in Siquijor.

Misamis is a low coastal province whose principal crops are coconuts and corn, and the larger towns thrive on the export trade of the interior. In Cagayan, the most important town visited in this province, lanzones are so frequently planted that they almost give the impression of growing wild; Plate II, *a*, well illustrates the conditions under which they are grown, interplanted with coconuts; Plate II, *b*, shows the habit of the lanzon and the size the tree attains. Two interesting varieties of what is probably *Citrus hystrix* DC., "Suha" and "Balincolong," were secured here, and in Tagoloan an exceedingly vigorous and distinct variety of the lime, known locally as "Limao;" "Pangapogon" is an unidentified species of *Citrus* found in Alubijid. From the information gathered it would seem that the "Suha" in Misamis is identical with the "Biasong" in Cebu of which material has been collected by Mr. George G. Weathersbee.

Quite a large number of species of fruit trees are found in Cagayan and adjacent towns, including the yambo, rare even in Philippines, and a white-fruited form of *Eugenia malaccensis* L.

The Baúno, *Mangifera verticillata* Robinson, (Plates III, *c*, and IV), to which further reference will be made presently, was

not found east of Talisayan in Misamis, though it is abundant in Butuan. Kayam, *Inocarpus edulis* Forst. (Plate VIII), was found growing in Talisayan, carrying a large crop of nearly mature fruit. The species seems to be but sparsely distributed in the Philippines. In fact, the tree in Talisayan was the only one seen during the trip. It is doubtful whether many places of the size of Balingasag, Misamis, can show as large a collection of bananas—twenty-seven varieties—as was here found by the writer.

Bolót, *Dioscorea fasciculata* Roxb., is grown to a considerable extent, comparatively speaking, around Tagoloan to Villa Nueva and is claimed to be superior to the Ube, *D. alata* L. In most places visited in the province locusts had damaged the coconuts more or less severely. A fruit fly infesting the mango was found in Cagayan.

Coconuts are the leading crop in Zamboanga and the adjacent country, and, seemingly, they succeed very well there. For the benefit of REVIEW readers outside of the Philippines who labor under the delusion that the nearer the equator the warmer the climate, it may be stated that Zamboanga, notwithstanding its latitude, has the reputation of being one of the coolest towns on the seaboard in the Philippines; the well-kept roads and clean streets speak volumes for the efficiency of all who are responsible for these conditions. Here, as everywhere else, bananas are the leading fruit. Large papayas and soursops of excellent quality are grown here in greater abundance than in any other place in the Archipelago that has come to attention of the writer.

Notwithstanding its good communication with Manila, Cebu, and Iloilo, where the mango is one of the leading fruits, the mango has not been well introduced into Zamboanga. More abundant than the mango is here the Juany, *Mangifera odorata* Griff., well named indeed, for a few fruits of this species are sufficient to "perfume" a large house. The main season of maturity of the Juany coincides with the mango, though the writer was informed that a few ripe fruits may be had at all seasons of the year. The fruit is far inferior to the mango. The Juany was found in abundance both on the south and east coast of Mindanao as far as Mati. Three other fruits, new to the writer, were obtained in Zamboanga, the Baúno, Marang and Durian, described in detail on another page of the REVIEW; Banegas, a large, yellow banana, also obtained in Zamboanga, is one of the best flavored bananas that has come to the attention of the writer, greatly superior to the Lacatán in aroma and flavor.

Manila hemp and coconuts are the two staple crops in Davao. The planting of coconuts is increasing at the expense of hemp, and the planters seem to be well justified in thus placing confidence for the coconut plantations seen in both Davao and Piso were in a flourishing condition.

The four days spent in Bukidnon and the seven in visiting the towns located on the Agusan River and its tributaries gave an opportunity to study the agricultural and horticultural conditions in these regions better than in any other place visited, though a longer stay and a trip further southward would have been desirable in Bukidnon.

The Agusan Province as constituted at present is divided into two subprovinces, the first of which, Butuan, is bounded by Surigao on the east and the Davao district of the Moro Province on the south; on the east lies Bukidnon, the second subprovince, and on the north the Surigao Sea. Butuan has a precipation of 2,137 millimeters well distributed throughout the year, falling mainly during October, November, December, January, February, and March; August is the driest month of the year. Agusan, the largest river in the Philippines, flows through the center of the province in a northerly direction, reënforced by numerous tributaries from the east and west along its entire course. It is navigable for light-draft launches (including the tributaries and canals that have been made across the swamps) for about 150 miles, according to Mr. Lewis; hemp is the chief export of Butuan.

A serious earthquake occurred in the upper Agusan Valley in 1903 which resulted in the settling of a large area, the river flowed backward, and the so-called "lake region," from Talacogon to Veruela came into existence. This region is still visited by frequent seismic disturbances, and the entire district is reported to be slowly sinking.

A trip on the Agusan is unique in its kind in the Philippines. From the mouth of the river to Butuan, the land is low, barely above tide water. Some coconuts are planted with here and there a sago swamp. From Butuan to Talacogon the elevation of the land above the river is greater, and the land wooded, the trees overhanging the river being frequently draped to the water with climbing plants, mostly belonging to Leguminosae and Convolvulaceae, in the greatest profusion, giving a charming effect; small clearings are passed from time to time, planted to corn and hemp. The climbing rattan palms, the tops of which rise above the rest of the vegetation, and a few fishtail and "Palma-

brava" palms, tend to relieve what after a while becomes almost a monotonous landscape. According to Mr. Worcester this land is practically never flooded.

The elevatión of Talacogon is said to be slightly more than 30 meters. Above Talacogon to Veruela the Agusan Valley is usually referred to as the "Lake Region." The rivers at normal heights here flow some 6 meters below the river bank and then again they overflow the banks and inundate the country. The river bank frequently slopes downward away from the river leaving a more or less impenetrable swamp beyond. In the inundated sections of the lake region the land is frequently covered with aquatic grasses and other herbs of luxuriant growth; at a slightly higher elevation, pandans with tall slender trunks make a picturesque addition to the landscape. On the lower half of the river bamboos are entirely absent, and in the lake region, where they are present, they consist of a dwarf bushy species with slender thin-walled canes unsuitable for building purposes. Epiphytic orchids occur almost everywhere in more or less profusion, and one of the interesting discoveries of the trip, *Vanilla philippinensis* Rolfe and one unidentified species of *Vanilla*, was made at Loreto, where it was found to grow in the greatest luxuriance, though in rather limited quantity. As far as is known no attempts have been made to obtain vanillin from these species, and plants were brought to Manila with a view of ascertaining whether or not the species are of economic value.

The Durian and Baúno are evidently indigenous here, and durian trees were seen that were estimated to be 20 meters in height and baúnos some 12 or more meters; bananas and papayas are abundant, but other fruit trees rather scarce, due to the comparatively recent civilization of the folk tribes occupying the country, their lack of communication with the outside world, and probably in no little measure to the fact that the river overflows its banks annually having at those times probably destroyed many introduced fruits in the early stages of the growth of the plants before they had the opportunity to become established. Under such circumstances it was surprising to encounter in Sagunto cacao trees in the best possible condition which were estimated to be at least forty years old.

During the short rainy season in November and December it is said that most of the "lake region" is covered with water until only the tree-tops are visible, and that the streets in many towns are navigable for rowboats when the floods come. Where such conditions obtain it is perhaps doubtful, in fact improbable, that

the country will ever become of much value agriculturally or horticulturally except for a people whose needs are few and who are content to live a primitive life. Yet during the season when the rivers are of normal height, rice and corn can undoubtedly be grown in the Agusan Valley in considerable quantities. However, considering the large areas of unoccupied land in the Philippines more readily accessible, more healthful, ready for the plow without any preparation save the burning of the native grass, it is questionable whether it would be advisable to colonize a country that is admittedly more or less unhealthful, swampy, subject to annual inundations and forested, the clearing of which would be costly and difficult. Judging from the appearance of the cacao trees seen here and there the encouragement of the planting of cacao by the natives would seem well justified in the more elevated regions of the valley. Pará rubber is likely to succeed, but the country is unsuited to the Ceará rubber.

Some day, when the more elevated sections of the valley to the east and west are opened to civilization, the Agusan and its tributaries, with some dredging and canal construction, will become the arteries of the province and provide a cheap and efficient mode of transportation.

Sago swamps covering more or less extensive areas are found from Butuan northward, and south of Talacogon, but it is problematical whether their extent is large enough to warrant the introduction of modern machinery for the extraction of sago; however, it is a situation worthy of investigation. At present the sago palm furnishes a cheap, nourishing, and easily obtainable food for the native inhabitants wherever it grows.

The sago palm, *Metroxylon Rumphii* (Plate III, *b*), has never been accorded the attention it deserves from civilized man. No starch-producing plant in the world will grow with so little attention; it flourishes on land on which most crops fail, and once established, it is established forever, for unlike most other palms the sago suckers freely from the base and the creeping stem, and sooner or later it may be found desirable to extend the sago swamps in Mindanao and perhaps to establish sago plantations in other parts of the Philippines. This interesting subject will be discussed in a future issue of the REVIEW.

Bukidnon, the sister province of Butuan, lies to the southeast of the latter, from which it is separated by a mountain range; south of Butuan it is bounded on the east by the Moro Province, which also surrounds Bukidnon on the south and east; on the north the province is shut out from the sea coast by the narrow coast province of Misamis. Bukidnon is very sparsely pop-

ulated, the population being estimated at about 27,000 by Mr. Lewis. No records of the temperature and rainfall are available, but as far as has been ascertained the latter is abundant and well distributed throughout the year. The least rain falls from January to April, but there are no continued dry spells.

Owing to the altitude the air is comparatively cool and refreshing and the nights almost cold. The climate is cooler and more agreeable than that on the coast and in the Agusan Valley and Bukidnon may justly claim the distinction of being one of the most healthful provinces in the Archipelago; typhoons are unknown.

Bukidnon is in many respects the radical antithesis of Butuan. In Butuan the inhabited country is low and inundated and rivers and canals afford the means of transportation; in Bukidnon mountain trails are the means of communication. The province may be said to be a vast tableland, with a probable mean elevation of the plateaus of 360 to 540 meters, not infrequently exceeding an altitude of 750 meters, the plains separated by mountains, canyons, and ravines, in the bottom of which flow numerous mountain streams and rivers. South of Tankulan all supplies and products are transported on the back of the carabao or the pack horse.

The main entrance into Bukidnon is the road leading from Agusan, a barrio of Tagoloan, to Tankulan, the construction of which has progressed sufficiently to be passable for wagons. (See Plate I, *a*.) The topography of the country has necessitated winding roads on the mountain sides and in the canyons, here ascending, there descending, though there is a steady ascent from Agusan over Tankulan and Maluco to Sumilao, said to have an altitude of 810 meters.

The scenic grandeur and the vegetative wealth increase in a geometrical ratio as one penetrates the interior. In the canyons an exuberant vegetation, including trees, herbaceae, ferns, here and there in tree form, climbers and orchids, prevails.

The plain reached after the first ascent was disappointing after the glowing reports that had been heard of the fertility of Bukidnon. The land here, which lies partly in Misamis, is sandy, gravelly, and stony, and supports a scanty vegetation, mainly grasses with occasional scrubby trees. The plains beyond what may be termed as the second ascent, consist of rich loamy or clayey oil, supporting a luxuriant growth of native grasses. The mountains and hills are frequently grass-covered to the summit and where they are wooded cinnamon grows wild in many places. Here is also found a stout, thick-walled bamboo

that is much superior to the bamboo used in Manila, and which ought to be introduced into other parts of the Philippines.

At present an infinitesimal area is cultivated by the native inhabitants, who a few years ago were but slightly above absolute savagery, living in the forests, which they have been induced to leave through the instrumentality of the provincial authorities and to settle on the plain. The government also extends to them "first aid" in breaking the virgin sod for them and assists them with seeds and plants of vegetable crops and fruits and plans their villages. If the existing natural vegetation on the plains was not already sufficient proof of the wealth of the soil, the growth of corn, upland rice, camote, cassava, and the fruits that have been introduced and are thriving certainly furnish convincing evidence to this effect. The need of the introduction of better varieties of corn is very evident.

Coffee, *Coffea arabica* L., is planted more or less in all settlements in Bukidnon, but it is improbable that it will ever become profitable except on the highest plateaus, because of the ravages of the coffee blight, *Hemileia vastatrix*. In fact, the blight is present in all coffee plantations visited in Bukidnon, but the disease seems to be innocuous above a certain altitude. According to Mr. Worcester the blight was very destructive here even when he first visited the region, when little care was taken of the trees and grass and weeds were allowed to crowd the plants. The natives having been persuaded to rigidly clean-cultivate their coffee, the coffee plants now seem to have gained sufficient vigor to resist the blight and are very productive. After the discouraging disappearance of the coffee ranches in the other parts of the Archipelago, this is almost too good to be true; nevertheless, it is a fact that there is a sufficient area of land in Bukidnon where coffee apparently can be profitably cultivated to supply our entire home demand, judging from the results attained during the last few years. However, it should be remembered that the blight is present everywhere, and that any condition that would have a tendency to devitalize the coffee plants would also in all likelihood invite an outbreak of the blight. Sumilao, Impasugong, Kalasungay, and Alanib are the centers of coffee growing, and the coffee produced there is of excellent quality.

The variety of fruits grown in Bukidnon is rather limited, though this is not surprising, considering the isolation of the province and how difficult transportation was in days gone by. Aside from the ever present banana and papaya, the lanzon is very plentiful in Sumilao, but the fruit produced here is said

to be inferior to that grown near the seacoast. The lanzon was here just coming into bloom, while at the same time it was offered in the market in Manila and Zamboanga. Oranges of remarkably good flavor were found in the convent garden in Sumilao and also limes, unsurpassed in productiveness, appearance, coloring, texture, juiciness and flavor. Unfortunately a fruit fly which infests the orange has found its way here. Pineapples are cultivated quite extensively in Bukidnon, comparatively speaking, while one also finds the jak, breadfruit, coconut, mango, sugarapple, soursop, guava, mandarin and lemon.

Cacao is grown in the canyons around some of the villages, notably Tankulan (Plate I, *b*), but the scaling of the cliffs in the transportation of the beans produced and of tools for the cultivation of the trees is too difficult to ever tempt the white man to utilize the canyons for this purpose. Hemp is also grown in the canyons; in fact, this is the principal export of the province.

With the advantages here discussed there is the present disadvantage of isolation from the outside world owing to the difficulty of approach, although a kind Providence has provided against this inconvenience in the falls and rapids of the rivers which could be harnessed and supply cheap motive power for the equipment of an electric railway. Thus the great distances would be anihilated and the days it now takes to travel would then be reduced to little more than hours, with the cost of transportation proportionally lessened, and Bukidnon, which, with its magnificent natural beauty, healthful climate, fertility of soil, abundant rainfall well distributed throughout the year, freedom from tropical storms, and an abundance of water for power, irrigation, industrial and transportation purposes, possessing perhaps more combined natural advantages than any other section in the Philippines, would be within a few days of Manila, and one of the trade routes of the world.

Generally speaking, the Tropics, with their opportunities for the exploitation of cheap and ignorant labor, have hitherto attracted the capital of the avaricious Caucasian rather than himself, and therefore, even in our day with its plentiful and cheap and widely diffused literature, the knowledge of the Tropics by the average citizen, be he American or European, is very hazy to say the least; to him it is the home of sweltering heat, terrific typhoons, malaria and fevers, mosquitos, lions and tigers, and dangerous snakes, a land unfit to live in, to say nothing of the more or less cannibalistic and savage inhabitants of the genus *homo*. While it is true that many parts of the

a

TYPICAL LANZONE GROVE IN CAGAYAN, MISAMIS.

b

FULL-GROWN LANZONE IN CAGAYAN, MISAMIS.

PLATE II.

a

DATE PALM (*Phoenix dactylifera* L.) IN SIQUIJOR, SIQUIJOR.

b

SAGO PALMS (*Metroxylon rumphii* Mart.), VERUELA, BUTUAN.

c

BAÚNO (*Mangifera verticillata*, Robinson), TALACOGON, BUTUAN.

PLATE III.

PLATE IV.—BAÚNO (*Mangifera verticillata*, Robinson)—FRUIT TWO-THIRDS, LEAVES ONE-HALF, NATURAL SIZE.

PLATE V.—MARANG (*Artocarpus odoratissima*, Blanco)—FRUIT ONE-HALF, LEAF ONE-FOURTH, NATURAL SIZE.

Tropics are subject to the above-mentioned disadvantages, yet those of us who have lived in the Tropics or subtropics know how woefully incorrect are these conceptions of large regions of the Torrid Zone. No small measure of this ignorance of the climatic and other conditions of the Tropics has been dissipated in the United States as a result of the construction of the railway through the east coast of Florida to Key West—which also had a disreputable reputation until within the last few years—with its consequent influx of a large army of men of moderate means who are rapidly building up thriving communities in that part of the state. The construction of the Panama canal has been another potent factor in dissipating this ignorance.

A majority of the people do not anticipate nor have they any ambitions to become millionaires or even wealthy; they are content with an opportunity to make a comfortable and independent living with sufficient means to provide their children with a good education. It is these that are settling south Florida, engaging in fruit and vegetable growing on farms which are 4 to 30 or more hectares in area. Much of agriculture in the Tropics is an intensified form of farming, more properly called horticulture, and thus a small area of land provides ample support for a family as compared with the land necessary in the Temperate Zone, where cereals are the leading crops. Bukidnon, after the construction of an electric railway from the coast to the interior, with its virgin soil, almost uninhabited, possessing the natural advantages which have already been dwelt upon, would seem to offer an excellent opportunity for colonization by small landholders of the class mentioned and such a class would not be so dependent upon a scarcity of suitable labor which so frequently is the bugbear of the moneyed investor in the Tropics. Pineapples and various other fruits could here be grown for canning purposes, citrus fruits for export, coffee on the higher plains, and cacao on the lower elevations. Corn, upland rice, various legumes, sugar cane, cassava, camotes, and yams have demonstrated their adaptability to the climate and soil. Whether cinnamon culture would be profitable is perhaps debatable, but it should not be forgotten that this plant grows wild in the foothills of the mountains and that the bark obtained is of excellent quality. Certainly no other province in the Archipelago offers a more attractive field for immigration for the inhabitants in the over-populated provinces in the Philippines, such as Cebu and Bohol, than Bukidnon.

Until the plains shall have been brought under cultivation and developed agriculturally and horticulturally, they will for

years provide excellent pasture for large herds of cattle, and even when the plateaus shall have been converted to waving fields of corn, rice and sugar cane, plantations and orchards, much of the broken country will still remain unoccupied for pastoral pursuits.

Whether or not the suggestions above receive serious consideration from those who are in a position to further the colonization of the unoccupied territory of Bukidnon, the provincial Government officials of the province have here one of the very best opportunities to benefit this and coming generations, and to erect to themselves a lasting monument by the planting of avenues of mangos and other fruit trees for shade along the roads over the wide plains. As has been pointed out in a previous issue of the REVIEW, fruit trees are frequently utilized in Germany as shade trees and there is no reason why Bukidnon should not set the pace in the Philippines, not to say in the Tropics.

The roads in Bukidnon, and the settlements of the natives upon the plains reflect great credit on those who have engineered this project, and so do the sanitary conditions there. The cleanliness of the villages is beyond praise and they are in this respect perhaphs unexampled in the Philippines.

THE DURIAN.

By O. W. BARRETT, *Chief, Division of Horticulture.*

The faultless fruit has not been found. Fruits there are, to be sure, which evince relationship with the Golden Apples of Hesperides, others without which the local inhabitants could scarcely exist, and others still which are delightful both to look upon and to taste.

There are also many fetid fruits as well as fragrant, but the most famous, the best, and perhaps the biggest of ill-smelling fruits is the Durian (*Durio zibethinus*). Without the unpleasant effluvium of this justly famed fruit, the mangosteen with its deplorably small quantity of pulp would have to look to its laurels as the best fruit of the world; for as regards size there are only a few of the tree fruits in popular esteem that can compare with the 2-kilogram (5-pound) Durian—nearly one-third of which is edible pulp and about one-sixth of which is edible seeds; nor can many fruits show a sugar content of more than 12 per cent with about the same amount of starch besides, and only a little over one-half water.

Some forty years ago the great naturalist Wallace made the statement that "to eat Durians is a new sensation, worth a voyage to the East to experience." And three hundred and thirteen years ago a Dutch botanist, Linschoten, declared it to surpass in flavor "all the other fruits of the world." Possibly the writer may have been spared the usual prejudicial impressions of the fruit by having been introduced to it a few years ago by no less an authority on tropical fruits than Dr. H. N. Ridley, the then Director of the Singapore Botanic Gardens.

The Durian is a native of Malaysia in a strict sense of the word, i. e., it grows well only in those countries inhabited by the Malay people—from the northern Federated Malay States through the Dutch East Indies and up into the Philippines as far as northern Mindanao. It has been introduced into most

of the tropical countries but generally only as a botanical garden or greenhouse specimen. It is usually considered as belonging to the Malvaceæ, or the family of the mallows, hibiscus, etc.; it has also been placed in the Sterculiaceæ, or cacao family. It is a question if the genus should not be given a separate order by itself since in many ways it is very distinct from the ordinary malvaceous plants and, by the same token, it scarcely resembles the cacao relatives except in point of the interior of the fruit. The tree itself is magnificent and stately, growing usually in open country in edges of forests, around native villages, and in clearings. It can hardly be called a cultivated fruit tree; at least, it is hardly ever grown in orchards, although on the other hand it could hardly hold its own in the wild. Throughout Malaysia it is considered the most delicious, if not the very best fruit, at least by the natives. Europeans, of course, generally consider the unpleasant odor of the fruit an insuperable factor; a fair proportion, however, of the foreign residents soon grow to relish the Durian and sometimes become staunch advocates of its use. Although it would not be wise, perhaps, for one unaccustomed to the fruit to consume a large quantity of the pulp at one sitting, there is apparently no substance in it which would cause indigestion or anything beyond a rather unpleasant breath for a few hours after eating.

According to the specific name, *zibethinus*, the fruit should osphresiologically remind one of the civet cat; the writer, however, after having seen and smelled live civets in Mozambique, does not concur in this idea. Neither is the odor like that of old cheese, nor of garlic, nor of onions, but it is of a nature peculiar to no other fruit. The taste suggests some multiple-flavored, aromatic custard, with a *soupçon* of turpentine, like the mango. The chemical body which is responsible for the very pronounced odor is probably one of the sulphur compounds with some base perhaps related to that in butyric acid; it is not an oil nor a sugar, not a true starch nor an inulin, but according to Dr. W. E. Pratt, a chemist of the Bureau of Science, who is probably the first chemist to make a thorough analysis of the Durian, it is a substance new to the organic chemist. The pulp contains a compound which, it is believed, is related to erythrodextrin but seems to exist, if such, in a new form in this fruit.

The principal features of the Durian's make-up are shown in the following table, an abstract from Dr. Pratt's forthcoming analysis:

Average weight of fruit (Jolo variety)	grams	2,200
Average weight of rind (including spines)	do	1,200
Average weight of seeds	do	350
Average weight of pulp	do	650
Acidity	per cent	0.1
Sugar	do	4.8
Sucrose	do	7.9
Proteids	do	2.3
Starch	do	11.0
Total solids	do	44.5
Ash	do	1.24

The seeds contain nearly pure starch; they are good either boiled or roasted, like chestnuts.

Like the innocent avocado the Durian has been—probably unjustly—accused of having pronounced aphrodisiac qualities; it is barely possible, of course, that such a reputed character would partly account for the intense popularity this fruit enjoys among the native peoples of its various habitats. Since, by the same token, it is also probable that the native does not fully realize the high nutritive character of the fruit, it would seem very evident that the Durian is eaten for its delicious flavor, purely and simply, and that the (to most people) unpleasant odor is merely a secondary phenomenon which in no way deters 99 per cent of the people acquainted with the fruit from partaking of it.

In passing we should not forget that there are Durians and Durians; some are said to be without a strong odor while to our certain knowledge some of the Borneo varieties are not at all objectionable. Borneo has at least six and probably ten varieties; some of these have only one or two seeds and are comparatively small fruits, while others are fully as large as our largest Jolo or Lake Lanao (Mindanao) forms; the pulp of some is nearly white, while that of others is pale salmon or even *orange* in color.

The Durian is one of the fruit-bat's favorite objects, not only as a tremendously attractive food but the rather ungraceful branches of the tree itself form a very acceptable roost for the flocks of these creatures, which probably have pleasant dreams during the hot, sunny days clinging head downwards to the branches, dreams of the past fruit season's exciting experiences when the appearance of the first crack in the fearfully spiny shell of a fruit was the signal for a grand mêlée with whirring wings and shrill ghostly cries. Probably no Durian was ever consumed in peace and quiet on its own stem by either bat or bird of any sort, for

soon after becoming thoroughly mature the very heavy fruit usually falls, sometimes killing or at least severely injuring the unlucky individual who might happen to be underneath. After the bats succeed in breaking the fruit from its stem they can, of course, make no further use of it since they cannot feed upon the ground; it then becomes a treat for the wild pigs or the half-wild swine of the natives.

In short, then, because of the majestic bearing of the tree itself—for there is scarcely a better tree in this respect; for its wonderfully beautiful silvery leaves, which are almost unrivalled in the tree world; for its curious silver-plated, golden flowers which few people, even botanists, have ever seen; for the unique exterior of the fruit—which mocks some of the breadfruits in outward appearance, but whose short brownish spines are so sharp and hard that only with a painful effort can one hold a good-sized fruit on the open palm; for its delicious pulp, with at least five distinct flavors; and last, but by no means least, for its very unique odor which has prejudiced most dilettante connoisseurs and given this near-king among the fruits an unsavory reputation to the world at large—we must needs regard the Durian as one of the most interesting fruit species of the horticultural world.

NEW PHILIPPINE FRUITS.

By P. J. WESTER, *Horticulturist.*

Considering the time that has elapsed since Vasco da Gama and Bartolomeo Dias rounded the Cape of Good Hope, and the time during which the Islands of Malaysia have been repeatedly explored, the average man may think that there is nothing left to discover in this part of the world. Geographically speaking, there is perhaps but little, though there are yet in the interior of the larger Sunda isles, and even in the Philippines, considerable areas that have never been trod by a white man; the naturalist, however, discovers new species almost daily, and even for the horticulturist there are still new fields to conquer. Only recently the Bureau of Agriculture received from Borneo seeds of seven varieties of Durians hitherto unknown in horticultural literature. Dr. O. Beccari quotes the names of twenty varieties of Durians in "Malesia," and describes three other species of the genus *Durio* having edible fruits; he also found several new Nepheliums cultivated there by the natives, and Mr. Staniforth Smith, the territorial governor of Papua, in a report of a trip through the interior of that country, speaks of having seen several new fruits there. Even the Philippines still have their quota of fruits unknown except in their native habitat, some of which have not even been described botanically until quite recently.

Excepting the "Tabu," which was discovered by Mr. Worcester in Palawan, the fruits described below were noted in Mindanao by the writer in August of this year, when he accompanied the Honorable Dean C. Worcester, Secretary of the Interior of the Government of the Philippine Islands, on an inspection trip through that island. With the exception of the Durian they are all believed to be new to horticultural literature; plant material of these fruits was brought to Manila for propagation with the idea of improving them through better culture and for the purpose of distributing plants to such localities as may be adapted to them climatically.

Baúno, *Mangifera verticillata* Robinson, also known as Bayono, Bayuno, Balono, or Balún. Anacardiaceæ. (Plates III, c, and IV.) A large tree sometimes exceeding 12 meters in height with a trunk 50 centimeters in diameter, growing in inundated regions in several parts of Mindanao, being particularly abundant around Butuan and in many places in the Agusan Valley and Davao, and occurring also in the Sulu Archipelago. The Baúno resembles the mango in habit and appearance though it is somewhat more upright in habit, of sparser foliage, more gnarled, and less attractive in appearance than the mango. The leaves are 12 to 18 centimeters long, elliptical to lanceolate or oblanceolate, coriaceous, smooth, with a prominent midrib. The flowers are small, blue, and appear in terminal panicles like the mango. There is considerable variation in the appearance, size, and quality of the fruit in the numerous trees. The fruit of the best is somewhat larger than a Carabao mango, from 11 to sometimes exceeding 13 centimeters in length, with an equatorial diameter of 7 to 8 centimeters, oblong oval to pyriform; stem usually inserted obliquely in a more or less irregular sinus; stigmatic area depressed; surface smooth; color yellowish green; lenticels numerous, small; skin very thin and tender, adhering closely to flesh; flesh white, very juicy, rich, sub-acid, quite aromatic, of excellent flavor, partaking somewhat of the flavor of apricot and soursop combined; the one seed is monoembryonic, large, oblong, and encased in matted coarse fibers that penetrate the flesh to more or less extent. The tree blooms in July and August and the fruit ripens in August and September.

The largest and best flavored baúnos were obtained in Zamboanga; very good fruits were found in Davao and Butuan and some that were very poor in Butuan and Surigao. The baúno is evidently very variable pomologically and the trees also seem to differ greatly in productiveness.

The excellent flavor of the Baúno assures this fruit a place among the tropical fruits on a par with the mango, as soon as a facile method of propagating the species asexually shall have been discovered so that material of the best seedlings may be obtained and systematic breeding begun, reducing the fiber in the fruit. Botanically as well as horticulturally the Baúno is a new fruit, having been named and described last year.

Juany, *Mangifera odorata* Griff. A medium to large tree, growing on the south coast of Mindanao and the Sulu Archipelago, differing but slightly from the mango in habit and foliage. The fruit is of about the size of the average mango, roundish

oblique, a trifle flattened; surface smooth; color green with a few large lenticels; skin very thick and tough; flesh yellowish, sweet, juicy, very resinous and very fibrous, odorous rather than aromatic, and to the novice at least, the flavor partakes altogether of too much turpentine to be agreeable; seed large and covered with abundant coarse fiber.

The Juany is far inferior to the mango, and in fact seems to have little if anything to recommend it where the mango will grow. Nevertheless it is found more frequently than the mango on well drained land in Zamboanga, Davao and in several other points visited as far as Mati on the east coast of Mindanao.

Herbarium specimens were also brought to Manila of a tree called "Paho," collected in Talacogon, which were pronounced by Mr. Merrill a species of *Mangifera,* hitherto unknown in the Philippines. No accurate description could be obtained of the fruit which is said to resemble a small mango and to be edible.

Marang, *Artocarpus odoratissima* Blanco, also known as Madang. Urticaceæ. (Plate V.) A medium-sized tree with large, dark-green leaves, entire or more or less conspicuously trilobate, 45 to 60 centimeters long and 25 to 30 centimeters broad, similar in habit to the breadfruit, found in the south coast of Mindanao and the Sulu Archipelago, and was first described from Mindoro. The fruit is large, 16 centimeters long and 13 centimeters in equatorial diameter, roundish oblong, regular, thickly studded with soft, greenish yellow spines about 7 millimeters long on the outside; rind thick and fleshy; flesh white, sweet, rich, juicy, aromatic and of good flavor, separated into segments (of about the size of a grape) clinging to the core; each segment containing a seed; seeds many, whitish, 8 by 15 millimeters, smooth, separating readily from the flesh. When the fruit is ripe, by passing a knife around and through the rind, with a little care the two halves separate from the flesh leaving this like a bunch of white grapes. Ripe fruits were obtained in August. The Marang is far superior to its relatives the jak and the ordinary breadfruits found in the Philippines, and already in its present form is a remarkably good and attractive fruit. The tree was noted by the writer in Zamboanga and Davao.

Togop, *Artocarpus elastica* Reinw. A medium-sized tree, somewhat similar in foliage and habit to the breadfruit, found in inundated regions in the Upper Agusan Valley. The fruit, which was not seen by the writer, is reported to ripen in March, and is said to be of about the size of the Marang and to resemble the breadfruit, to which it is alleged to be superior in quality.

According to Mr. E. D. Merrill, the Togop is not found in the Philippines outside of Mindanao.

Kambog, *Dillenia speciosa* Gilg. Dilleniaceae. (Plate VI.) A very ornamental tree, attaining a height of 10 to 15 meters, with large, elliptical oblong, serrate, dark green leaves, 45 to 50 centimeters long, and 18 to 22 centimeters broad, found in Mindanao, the Visayas, and in some parts of Luzon. The fruit is about 55 millimeters long, and 75 millimeters in equatorial diameter, broadly cordiform, greenish, smooth and shiny. The sepals are persistent and grow large and fleshy, inclosing the edible part of the fruit; the interior consists of numerous carpels, greenish, fleshy, subacid, adhering to a central core around which they wind spirally, each containing one or more small seeds, which separate readily from the flesh. Mature Kambog fruits were collected in August by the writer in Loreto on trees growing on inundated land.

Libas, *Garcinia vidalii* Merrill. Guttiferæ. (Plate VII.) A small ornamental tree, attaining a height of 10 meters, with large, roundish oblong, thick, leathery, dark-green leaves, with short petioles and prominent midrib. Rather rare north of Mindanao. Fruit roundish, 50 millimeters long and 54 millimeters in equatorial diameter, smooth, with numerous small lenticels, stigmatic area quite large and prominent. Mature, the fruit is said to be rather acid and of good flavor. The fruits obtained by the writer were fullgrown but too immature to permit testing. The only tree of this species noted was seen in San Vicente, Butuan. The species is evidently quite vigorous, and may, aside from its pomological value, prove a good stock for the mangosteen, to which it is related.

Tabú, an unidentified species, said to grow on a vine, obtained by the Hon. Dean C. Worcester, at Separation Point, Palawan, who presented seeds to the Bureau of Agriculture through the writer. The fruit is of about the size of a pomelo, with a thick, smooth rind that separates from the flesh. According to Mr. Worcester, the flesh consists of a large number of juicy, subacid segments, separable from each other and the rind similarly to the mangosteen, which fruit the flesh also strongly resembles in flavor. Altogether the Tabú is reported to be a very attractive and well-flavored fruit. The mature fruits were obtained in July and the writer had unfortunately not the opportunity to sample this interesting fruit.

Kayam, *Inocarpus edulis* Forst. Leguminosæ. (Plate VIII.) A large spreading tree, leaves oblong, entire, with short petioles.

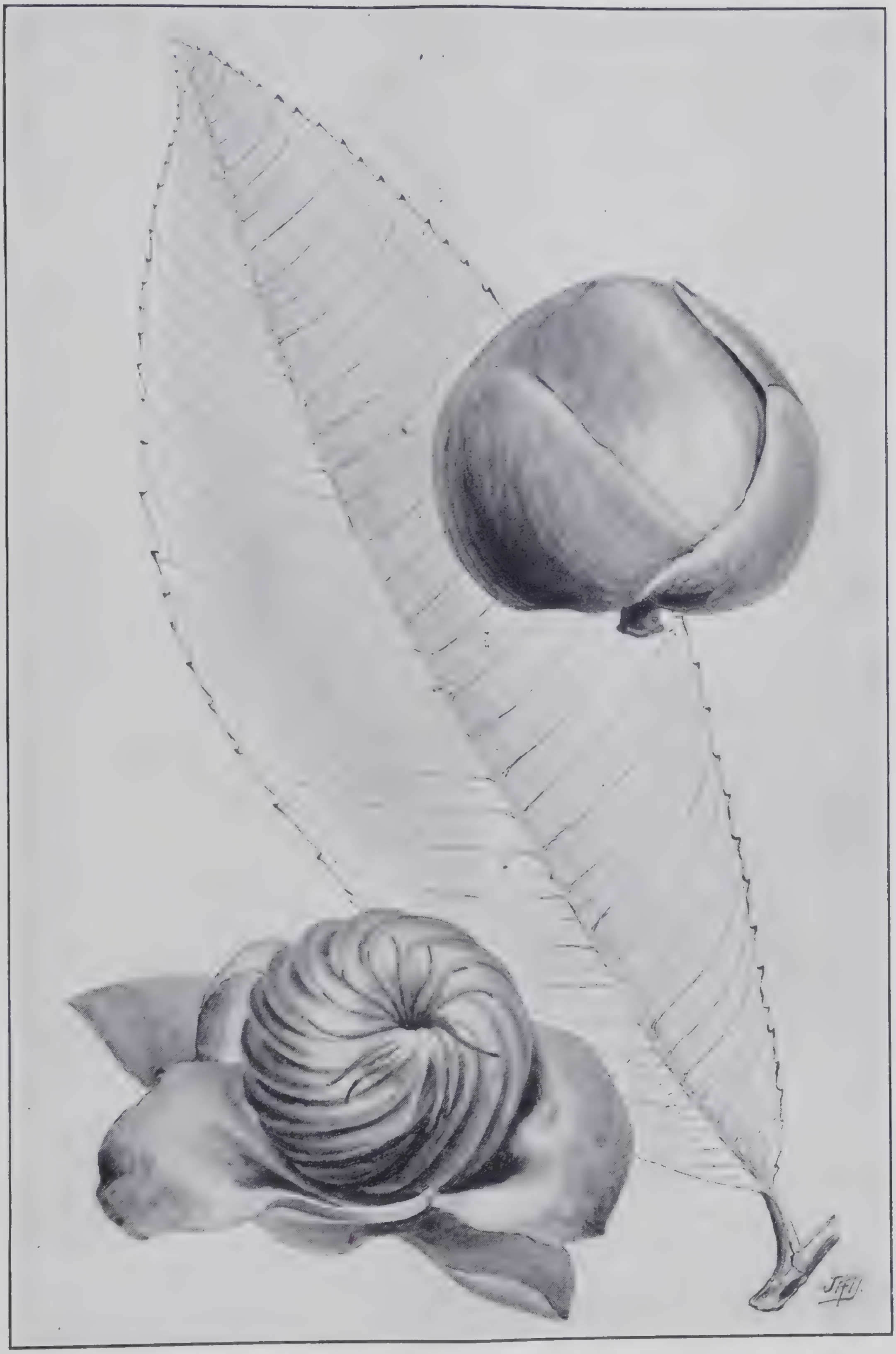

PLATE VI.—KAMBOG (*Dillenia speciosa* Gilg.)—FRUITS TWO-THIRDS, LEAF ONE-THIRD, NATURAL SIZE.

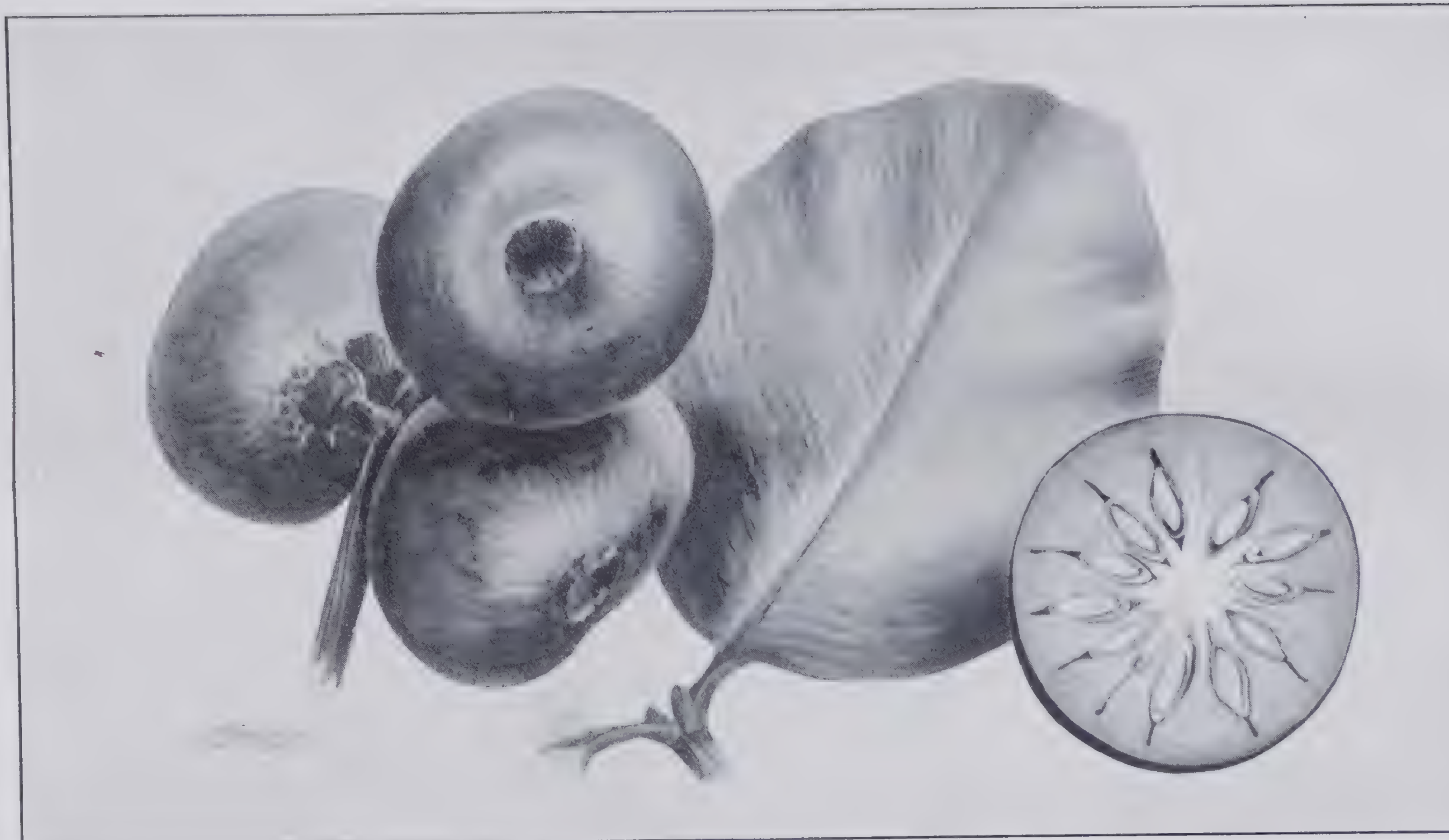

PLATE VII.—LIBAS (*Garcinia vidalii*, Merrill)—FRUIT ABOUT FOUR-FIFTHS, LEAF ABOUT TWO-THIRDS, NATURAL SIZE.

PLATE VIII.—KAYAM (*Inocarpus edulis* Forst.)—FRUIT NATURAL SIZE, TWIG AND LEAVES ONE-HALF NATURAL SIZE.

PLATE IX.—HALF-SECTION, DURIAN FRUIT, JOLO VARIETY. (21 by 16 centimeters.)

(Photo by O. W. Barrett.)

sparingly distributed in Mindanao and the Visayas. The fruit consists of a short, fibrous pod, 75 millimeters long, 60 millimeters broad and 34 millimeters thick, reniform, flattened, containing a large bean. Fullgrown but not quite mature fruits of the Kayam were obtained in Talisayan, the only place where it was seen by the writer. The fruits are roasted or boiled, and eaten, and in some parts of Polynesia and Malaysia are an important staple of food. Aside from its culinary value the Kayam makes a very desirable ornamental shade tree.

Durian, *Durio zibethinus* Lam. Sterculiaceæ. (Plate IX.) A very large tree, sometimes attaining a height of 30 meters, with alternate, ovate, oblong, acuminate leaves, entire, greenish above, silvery beneath. The flowers are produced in a cluster from the bare twigs or branches, the fruit is roundish or oblong and sometimes exceeds 3 kilos in weight, the thick horny rind being covered with hard spines about 12 millimeters long. On ripening, the fruit turns a yellowish gray and splits open into five parts from the apex, dividing the compartments containing the flesh and seeds. The flesh is whitish, buttery, melting, sweet, rich and very aromatic and separates readily from the woody "shell" and the seeds. Each compartment contains from one to four large seeds. To a seasoned Durian eater this fruit may be "worth a voyage to the East," to quote Wallace, but to the novice it is nearly always nauseous and offensive. To the writer garlic seemed to be its most dominant flavor.

The Durian is quite well known in horticultural literature but its cultivation has never been greatly extended beyond its native habitat. It is found in many places in Mindanao and is particularly abundant from Davao to the lake region of Agusan Valley and to a somewhat less extent in the northern part of Agusan. It also occurs in the Sulu Archipelago.

The Durian has hitherto never been successfully introduced in the Philippines north of Mindanao.

Trees and plants require certain climatic conditions in order to succeed, such as a certain degree of heat, light, rain and humidity, not to speak of soil requirements, and without which the plants would fail. It is not believed that the fruits described above will succeed in all parts of the Philippines but they will undoubtedly grow in many sections of the Archipelago to which they are now foreign.

SOME NEEDED NAME STANDARDS.

By O. W. Barrett,
Chief, Division of Horticulture.

In the matter of stopping the usage of undesirable words prevention greatly excels attempted cure. Horticulturists in general regret that prompter action was not taken in regard to some words which have now gained so strong a foothold in the English language that it will be almost impossible to eradicate them. Botanical nomenclature is necessarily a more or less confused affair, but that is a matter for scientists themselves to worry over; whereas the terms and names in daily use in the line of horticulture, and for that matter in general agriculture, are words used by the majority of people. Here lies an interesting fact in the sociological, or rather the psychological, side of the question: we are always prone to associate one word with others which resemble it in sound or appearance, and by that association of ideas much good or ill may befall the object or word in question.

While it is true that there are plenty of cases of splendid profits being made, sometimes without a substantial reason therefor, through the fortuitous employment of a word or "catchy" phrase, there are probably just as many cases to the contrary. The writer has in mind, for instance, the case of a very promising industry that was said to have been ruined by the inadvertent use of the word "tubercle" instead of "tuber:" one can readily see that for a company to use, even accidentally, a word which is so frequently associated with a certain serious disease is to court disaster—even if we blame the result on phthisiphobia.

The following cases of misspelling, misapplication, and misuse of more or less good synonyms are worthy of interest.

Coconut.—Fortunately in the Philippines there is practically no need to warn the public against the old-fashioned spelling "cocoanut." The British forms of the word, "coco-nut" and cocoa-nut, should be discontinued as soon as possible, since strictly speaking, the object is a *fruit* just as much as a nut, and since

it is now such a common and well-known article there is no excuse for inserting the hyphen any longer. By the same token *copra* is the correct name for dried coconut "meat;" the addition of "h" (British system) or "x" (Spanish style) is neither decorative nor useful.

Cacao.—This refers not only to the tree itself but to the seeds produced therefrom. The term *"cocoa"* should be applied only to the product manufactured from the seeds—a trade term, like chocolate. By the way, the final vowel in "cocoa" is interesting as being one of the very few cases of an absolutely useless vowel in English; the original suffixion of the "a" was possibly excusable to distinguish that word from the six or eight other disyllables using "c," "o," and "a" in various combinations.

Avocado.—Objection to this word is gradually dying down, but, for some unknown reason, there still lingers in the minds of thousands of people an apparent preference for the hideous name "alligator pear;" this is probably due, however, to the plebian shrinking from any foreign-sounding word, especially if it has more than three syllables. It is said that the first use of the abominable epithet was by one Jack Tar who had been allowed shore leave somewhere in Central America where the days are not alone in being hot, where alligators make lasting impressions, and where some of the people still call the fruit "ahuacate," after the old Aztec "ahwacatl." Yet because one tired tongue refused to encompass the full measure of the really euphonious *avocado* is no reason why a perfectly good fruit, which ought long ago to have been exceedingly popular, should continue to struggle under such an opprobrious name. By the same token, many of the avocado types have no more resemblance to a pear than to a plum or pomegranate either in color or shape, to say nothing of the interior. To illustrate the obstinate attitude of the retail merchant, the writer recollects a case in Washington, District of Columbia, where the disgusting sign "Fresh Alligator Pears Today" was flaunted in the people's face, year after year, although the proprietor admitted that most of the purchasers of the fruit asked for *avocados.*

Mango.—The plural of this word is properly written without an "e." There is no good reason for adding a useless "e" to the other analogous foreign words which would not, when at home, so to speak, be given such a decoration, viz, tomato, potato, pomelo, chico, baúno, and, of course, avocado.

Pomelo.—This good old word has been discountenanced in most parts of the United States and a rather weird and quite

unreasonable substitute has been upheld, even by a few horticulturists. This substitute flourishes as "grapefruit," "grape-fruit," and "grape fruit." There are two theories anent the origin of this pseudonym: a gentleman at the Boston docks, coming upon a sample package of pomelos from the West Indies, and being quite unacquainted with the fruits, tested one and not having in mind just then anything else with which to compare the fruit declared that it reminded him of *grapes* (presumably of the Frost variety). The other and perhaps more reasonable theory is based upon a tourist's remark in passing some pomelo trees for the first time in the Tropics: noting that the fruits were sometimes clustered together near the ends of the branches he innocently opined that in that character they reminded him of *grapes.* The flavor, however, is so unlike that of any grape and the clustering habit of the fruit is so inconstant and so unfamiliar to 99 per cent of the users of the fruit, that it is strange if there is not a twinge of conscience in the mind of every person applying that false name to one of the best citrus fruits the world has ever seen—and the one which has made the most money for its growers, with the exception of the orange, perhaps, since the two species left their ancient home in India and the Far East.

Chico.—This excellent Tropical American fruit has traveled under several names, such as "naseberry," "sapodilla," "chico zapote," and others; but since it is not a berry nor any kind of a zapote, let us adopt the convenient little name which even Mrs. Grundy should have no difficulty with—except that it sounds "foreign" and therefore *might* have a meaning (sic) less nice than its flavor.

Yautía.—This good old Arawak word originally meant "place of the Hutia," or so-called Spiny Rat of the Antilles. This tuber vegetable is supposed to be the very oldest crop cultivated by man; and we can imagine the savages of twenty thousand years ago being obliged to choose a word which would clearly signify that object which was always to be found in the places frequented by their common game animal, the now early extinct Hutia. This plant has been called "coco," "eddoes," "otó," and "macal" in various countries of Tropical America. Worse than having a number of names is the fact that the yautías were for many years confused even by botanists with the *taros* which belong to quite another genus of plants with *peltate* leaves instead of arrow-shaped.

It will be an interesting question to note whether it will be

possible to accustom the Filipino planters to the use of the word before they get the idea settled in their minds that it is only a kind of "gabi"—which it resembles, of course, in habit.

Feijoa.—The name of this new fruit is to be spelled in English as in Latin but the Portuguese pronunciation (fay-zhó-a) is to be given it out of honor to Snr. Feijoa, a Brazilian gentleman, after whom it is named. This fruit will be very widely known, we believe, within a few years on account of its remarkably strong perfume and fine flavor, and now is the time to correct the spelling and pronunciation of the name.

Cherimoya.—This Central American fruit is now successfully introduced into the Philippines in the form of several varieties and even hybrids between *Anona cherimolia* and other species of Anona, and it is rapidly becoming very popular in California. It is also spelled Chirimoya, Cherimolia, and Cherimoyer, and, especially in California is often confused with the custardapple.

Custardapple.—This, not being an apple in either shape, size, color, or flavor, should either be written as one word, or better still a new word should be decided upon to take the place of the rather awkward and long name it now bears. The once fairly common West India name of "Bullock's Heart" has fortunately been dropped.

Sugarapple.—This also should be written as one word. It is also called Sweetsop in many British colonies. A new name is needed.

Mamon.—This fruit has also suffered under the names "Alligator Apple," "Monkey Apple," and "Pond Apple," but since it has nothing to do with any of the indicated objects it should be given a square deal.

Hevi.—This fruit has passed under the name of Otaheite (or Tahiti) Apple, or Vi, but the old Polynesian name used in its own home, so to speak, is much to be preferred. It is properly known to botanists as *Spondias cytherea* (*nec S. dulcis*).

Roselle.—This promising new vegetable-fruit came near being called "Jamaica Sorrel" a few years ago; the principal reason for such a name was the sour taste of the leaves and the so-called fruits. By the way, it has recently been misquoted, purposely or otherwise, as "Grosella," which is translated currant.

Baúno.—This new fruit in its very brief period of existence before the horticultural world has already been called Balun, Balono, Bayuno, and Bayono; but, there being little choice among these names, we should follow the native name mentioned in the original description by Mr. Robinson, of the Bureau of Science.

Papaya.—This word is probably Polynesian in origin and, therefore, of very easy pronunciation. It is not a "tree melon" and since another fruit (*Asimina triloba*), quite unrelated, is also called "Pawpaw" the latter word should be dropped as a synonym.

Cassava.—While there may be some reason for using the old Brazilian word "manioc," or "mandioca" for this crop, there is no good excuse for the Spanish-American "yuca," nor the fortunately rather rare British East Indian "tapioca." It is pardonable to sometimes use the commercial product when figuratively speaking of a raw material crop but we should no more speak of a "tapioca plantation" than of a flour field.

Soursop.—Unfortunately there seems to be no escape from using this objectionable name for a perfectly good fruit. It is known as "Araticú" in Brazil, as "Guanábano" in Spanish America, and "Guyabano," etc., in the Philippines, but since we are dealing with English words we must fall back upon soursop for *Anona muricata.*

Yambo.—This fruit certainly does smell like roses and taste as roses ought to taste, but it is not an apple in any sense of the word and, therefore, we should relinquish the beautiful but inapropriate name "roseapple." "Jamrosade" is also too much of a good thing; but yambo is the old name for this excellent fruit—which, we hope, will soon be much more popular here.

Mandarin.—Let us not use the word "tangerine" any longer. Tangiers, or as we should say, Tanger, is the adopted home of many good citrus fruits but it is hardly fair that we should accredit that city with the so-called "kid glove" type of oranges (*Citrus nobilis*) which was quite certainly brought out of southern China where mandarins have raised them for centuries.

Maize.—Out of deference to the Spanish "maís" and our British neighbors who more or less correctly regard several other grains as corn, let us adhere firmly to the old (pre-Columbian Arawak "mahiz") correct name by which it is known practically everywhere outside of the United States; at this late date it would be useless to attempt to substitute the correct for the popular term there, but we are just in time here in the Philippines to start right.

CORN DEMONSTRATIONS IN THE PHILIPPINES.

By Benj. P. Lukens, *Chief, Division of Statistics.*

The Bureau of Education is carrying on a constant and consistent campaign for the betterment of the food supply of the Philippines. Its object is twofold: the improvement in quality and variety, and the increase in quantity. The severe drought of the past year attended by a great shortage in the rice crop showed clearly the danger to the people of depending too much on one sole crop, and especially a crop so sensitive to weather conditions as rice.

Commencing in June of this year the Bureau began an energetic and practical effort to interest the people in maize and to prove to them that maize as an article of diet was more nutritious than rice and as a plant was hardier and more easily raised. It was not the desire to supplant rice but to supplement it as a food and to utilize in corn culture land which now lies waste or untilled.

Realizing that the Filipinos made very little use of maize as a human food largely because they understood only one or two primitive ways of preparing it, the Bureau decided to popularize it by holding "Corn Demonstrations" in every municipality and school district in the Islands—more than one thousand in all. These demonstrations were to consist of public gatherings on the school grounds and in school buildings where the maize would be put through all the processes of preparation and cooking under the very eyes of the people and they would be given an opportunity to eat the various dishes thus prepared. Two of these "corn demonstrations" were held near Manila and a brief description of them will give a better idea of what the plan means.

On August 24 the first one was held at Pasig, Rizal Province. Under the supervision of the division superintendent of schools, Mr. Russel Trace, and all of the American and Filipino teachers of the provincial school, the grounds around the school building

were converted into a series of ornamental corn booths made almost entirely of corn stalks, leaves and ears, and decorated with festoons of thousands of grains strung together on threads. The words "Corn is King," executed in cornstalks, stood out prominently over the entrance to one of the buildings. Each booth was devoted to only one phase of the work and was under the charge of one or more demonstrators. The chief object was to show how many simple yet palatable kinds of food could be prepared from common corn. The following dishes were served at the various booths: hominy, mush, hoe cake, johnny cake, corn with tomatoes, stewed corn, fried corn, and corn-starch pudding. Three thousand six hundred services of food were made to more than one thousand people. Recipes for the different dishes were distributed in Tagalog and English. One interesting feature was the singing of specially prepared corn music written and adapted for the occasion by one of the teachers. Exhibits were made of cornstalks with two ears, ears in husk, ears husked, corn-leaf fodder, seed testing, and the making of hominy. A modern hand grist mill and a native hand stone mill were in operation side by side, and nearby a small corn sheller. The actual outlay of cash was ₱67 for materials.

The demonstration at Malabon was held two weeks later on September 7. By reason of the publicity given to the Pasig demonstration and its pronounced success it was possible to interest more people in the Malabon display. The crowd of visitors numbered more than five thousand, among whom were the acting Governor-General, several Bureau chiefs and others high in authority. Under the leadership of Mr. J. B. Graham, supervisor of the primary schools, Mrs. M. A. Keeney, principal of the intermediate schools, and the Filipino teachers in both the primary and intermediate schools, the demonstration work was carried into very elaborate detail. In the eight booths located on the grounds of the intermediate school sixteen different corn dishes were served. These were classified in the form of breakfast foods, soups, entrees, meats, vegetables, salads, desserts, and corn coffee. The entire list included the following: mush, hominy, corn pone, hoe cake, pan cake, corn soup, corn oysters, tamales, corn with meat, corn bread, stewed corn, fried corn, corn with tomatoes, corn salad, corn-starch pudding, and corn coffee. At the entrance to the ground was an arch bearing the legend "Corn City." This arch and its letters were prepared from corn stalks, leaves, ears, and grains. The booths were also decorated in a similar manner. A special feature of the occa-

sion was a "Queen of Corn" whose horn of plenty was filled with corn, whose scepter was corn, whose crown was of golden corn, whose robe was gorgeously embroidered with pearls of corn, and above whose head was an elaborate design of the seal of the Philippine Islands wrought in various colored grains of corn. Displays were made of the proper methods of selecting seed, planting and cultivating. Stalks with two ears were exhibited and hand machines were in operation showing the modern means of shelling and grinding corn.

More than a hundred of these corn demonstrations have already been held in different parts of the Philippines but full reports have not yet been received. They will all follow the same general lines as those of Pasig and Malabon. It is hoped to convince the public that maize is a most desirable food from the standpoint of economy, nutritive qualities and hardiness under adverse weather conditions.

SOME PHILIPPINE BANANA RECIPES.

By Mrs. O. W. Barrett.

With the desire of enlarging our list of vegetable and fruit dishes the following somewhat unusual recipes are submitted:

BAKED BANANAS.

Baked bananas; as a desert dish.—In an enamelled dish place thin lengthwise slices of "Sabá," covering with a thick sprinkling of brown sugar dusted with a bit of cinnamon; add one-fourth teaspoonful of butter for each slice. Bake till the "Sabá" is translucent and sirup has formed from the "Sabá" juice and sugar.

Baked bananas; as a vegetable.—The "Latundan" and "Sabá" are best for this; only perfectly ripe fruit should be used. The unpeeled fruit should be placed in an enamelled dish and baked just in time to be served hot; send to the table in the skin, as hot as possible, adding a bit of butter, lemon, or salt, as desired. "Latundans" require 10 minutes, "Sabás" about 20 minutes, in a hot oven. Do not allow fruit to remain in the skin long after being baked as the skin causes the fruit to become slightly acrid.

FRIED BANANAS.

Select perfectly ripened "Sabás." Allow 1 teaspoon butter for three small fruits; fry thin slices until slightly browned, dishing at once. Too long cooking produces a "watery" condition. Lemon juice may be added at the table. "Latundans" are good fried but should be cut in thick slices.

BANANAS IN SOUP.

In the West Indies slightly acid bananas similar to our "Latundan" are sliced and added to soup just at the moment of serving, being especially good in tomato soup.

BOILED BANANAS.

Boil in the skin till soft several "Sabás." Peel and add salt, pepper, and butter, and serve as a separate vegetable course.

Boil in the skin till soft several "Sabás." Peel, cut in 2-inch lengths, and, at serving, add to a beef-stew, pot-roast, or corned-beef-and-cabbage stew.

BANANA SALAD.

The "Lacatan," "Bungulan," and "Latundan" are best for salad purposes. Always prepare with a silver knife, and always scrape from the fruit the fibrous strips of peel that often cling to the fruit. Besides the well-known combinations of bananas and apples, nuts, or celery, sliced bananas are especially good served with chopped figs, dates, or white cherries mixed with the regulation mayonnaise dressing.

BANANA BUD.

Remove the purple leaf-bracts from the outside of the banana bud (from the tip of the bunch). Boil this white heart about 30 minutes. Cut lengthwise; serve hot with spiced butter sauce, or cold with salad dressing.

The unopened flowers from several buds may be removed from the bracts and cooked like string beans, or mongo sprouts.

BANANA PUDDING.

Slice ripe "Lacatan" or "Latundan" bananas in a baking dish adding a tablespoon of water and a teaspoon of sugar for each banana; bake about 20 minutes in a moderate oven. Add well-beaten whites of two or three eggs sweetened with a tablespoon of sugar. Return to oven for 5 minutes. Serve cold.

BANANA BREAD PUDDING.

In a baking dish place alternate layers of buttered bread and sliced "Latundan" bananas adding 3 eggs well beaten with 3 tablespoons white sugar and sufficient milk to cover. Bake 20 minutes in a moderate oven. Good served hot or cold—with a tart jelly or hot chocolate sauce.

CURRENT NOTES [1]—NOVEMBER.

UTILIZATION OF SISAL WASTE.

Ever since the invention and successful operation of fiber-extracting machines, the economic utilization of sisal and henequén waste has been the subject of extensive tests and experiments by scientists. The results so far obtained show that this waste may be economically utilized for the following purposes: Manufacture of industrial alcohol, as a fertilizer, and as a stock feed.

In a current note in the September issue of THE PHILIPPINE AGRICULTURAL REVIEW a brief résumé was given of the results of M. D. Herelle's and other chemists' experiments in the manufacture of alcohol from henequén waste which seemed to indicate that this industry can be made remunerative in spite of the difficulties encountered in fermenting the waste. The results obtained from Mr. William McGeorge's experiments in sisal waste in Hawaii, however, are not as encouraging as the former. In his report, published in Press Bulletin No. 35 of the Hawaii Agricultural Experiment Station, dated June 12, 1912, Mr. McGeorge sums up the results of his experiments as follows:

> In view of the comparatively small quantity of waste accruing at present at the Hawaii plantations and the very low sugar content of sisal leaves, it is not deemed a profitable undertaking to utilize the sisal waste of Hawaii for making alcohol, taking into consideration the difficulties to be overcome in the fermentation. Several fermentations were made by the author in this laboratory, and while an alcoholic fermentation was obtained by using ordinary compressed yeast, the yield was very poor and indicated the difficulties to be overcome. * * *
>
> In our analyses the sugar content of the fresh leaf varied from 2 to 7 per cent, making an average of 4.5 per cent, which theoretically would yield about 26 liters (or 6.5 gallons) absolute alcohol per ton of leaves. It is hardly conceivable that with such a sugar content this could be made a remunerative industry with the waste at hand, and even with the large quantities of waste at Yucatan it would require a rather efficient method.

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[1] Original notes prepared by various members of the Bureau of Agriculture.

As to the utilization of sisal waste as a fertilizer, the Press Bulletin referred to above mentions the belief that this is the best economic utilization that could be made of the waste at the present time. It states that the value of the waste for fertilizer purposes is estimated at $6 a ton and is consequently greater than the value of the fermentable substance for alcohol production. Herbert and Heim are also mentioned as having reached the above conclusion.

The utilization of sisal and henequén waste in the fresh form as stock feed is also reported to have given fairly satisfactory results in some countries. The waste contains a fairly high percentage of sugar from which it derives its nutritive value, and it is believed it will give very satisfactory results especially when it is used in the dry form and mixed with other feeds. (*M. M. Saleeby.*)

CORN AND RICE ROTATION.

The farmer who does not keep his land busy is not making the best use of his capital. If it is possible to grow three crops on land and only one or two are taken, the farmer has lost the value of the extra crop if he fails to take it. The farmers in those sections where irrigation water is available could, if they manage their farms properly, take off one crop of corn in addition to two crops of palay.

The following procedure is suggested. Starting the first of April, the rice field may be broken and planted to corn. One hundred days should be sufficient to mature the corn and remove it from the field. The seedbed for transplanting the field to rice should be planted by June 20, then if the corn is removed by July 10 the field should be prepared and transplanted by August 1. One hundred and fifty days from sowing the palay seed to harvest should bring us to November 20. Then by having the seedbed prepared by October 20 this field should be transplanted again by December 1. By March 20 this crop should be out of the way and still have sufficient margin for planting to corn again by April 1. This plan has several things to recommend it.

First. Corn planted in April will produce the best crop of the year, provided, of course, that irrigation water is used.

Second. Palay transplanted August 1 will have the best season for its development and will ripen in good weather. The second crop grown as indicated would develop better than if planted later because the hot sunshine retards development.

Third. Cowpeas or mungos could be planted with the corn and thus improve the land. (*C. M. Conner.*)

PILI NUTS.

During the last few years the world has come to realize that nuts as food have not been given due credit; but in the United States at least there is a sort of nut crusade on at present. Possibly the exquisitely flavored new varieties of pecans which are just beginning to become well known throughout that country are largely responsible for this renewed interest.

There is no question but that the Pili will soon be a common and popular nut in confectionery, at least, in the Eastern States. A recent shipment (part of the million-peso cargo of the steamer *Shimosa*) of some 3,500 bags was made from Manila direct to New York. Several large shipments have also been sent to San Francisco from here. Unfortunately little seems to be known regarding the best conditions under which the three or four commercial kinds of Pili nuts are produced. The principal localities from which they are now obtained are the Albay Peninsula and the Province of Tayabas.

According to Mr. E. D. Merrill, botanist of the Bureau of Science, there is some confusion at present regarding the scientific nomenclature of the Philippine Pilis. They are all, of course, of the genus *Canarium* of the Burseraceæ, a family noted for its resins and gums. The rather valuable genuine "gum elemi" of the Philippines is nothing but Pili resin; it is a brilliant white, almost solid, pitch-like substance, with a pleasant, aromatic, terebinthine odor; it is used in pharmacy, its stimulating properties being of good use in ointments, plasters, etc.

The texture of the kernel is almost ideal; it is exceedingly light without being spongy, brittle without being hard, and highly flavored without being oily. It is so easily digested that a kind of infant food is said to be prepared from it, the blanched kernels probably being pressed to remove excess of oil and then ground. The blanched nuts, browned and salted, are fully equal to either the "Paradise" or Brizil nuts and of much better texture than almonds; they may also be eaten raw. Even the pulpy husk of thoroughly ripe nuts is eaten by the Filipinos in some districts.

It appears that nowhere in the Philippines is the Pili actually cultivated, though in the Moluccas a species, which may also occur in Mindanao (*C. commune*), is actually under cultivation.

Some ₱20,000 worth of Pili nuts were exported from Manila in the first quarter of the present fiscal year. (*O. W. Barrett.*)

CARDAMONS.

The "Tropical Agriculturist" for August contains two interesting papers on cardamon culture. It is considered that this spice may have been used in India at a remote period and cardamons were known as a Singhalese product about 1154.

Cardamons are the product of *Elettaria cardamomum* Maton, indigenous to Ceylon and Malabar, where it grows wild at an altitude of 750 to 1,500 meters and where it also is cultivated; Siam, China, Malaysia, Madagascar, and West Africa also produce cardamons.

The cardamon succeeds best in rich loamy soil in well sheltered, moist localities with a mean annual temperature of 72° F. and a rainfall of about 3,000 millimeters and is grown under partial shade. The plants are set 210 centimeters apart each way. After the plantation comes into bearing the crop is gathered from August to the following April in successive pickings, the annual yield sometimes totaling 225 to 235 kilos per hectare. Ceylon produced in 1910 182,697 kilos and India 290,550 kilos of cardamons of which 40 per cent went to the United Kingdom. Sweden, Norway, Russia, and parts of Germany are among the principal users of cardamon for culinary purposes and the demand for the spice in the United States and Turkey is growing.

Because of the nature of the product and its comparatively limited demand, which is easily oversupplied, the culture of cardamons can not become an industry of great magnitude. However, in a limited way, this spice would be likely to become profitable in many parts of the Visayas south of the typhoon belt and in Mindanao if it were introduced and rightly handled. (*P. J. Wester.*)

RATE OF PLANTING CORN.

One of the most serious drawbacks to the production of corn on a profitable basis, in at least a part of the Island of Luzon, is growing it entirely too thickly upon the ground. Not even the famous "Corn belt" of the United States could produce corn if the fields had as many stalks per unit of ground as is found here. With the prevailing method of planting there, in hills of three stalks each, about 105 centimeters apart each way, a hectare of land would have growing on it about 18,000 stalks. Not infrequently it has been found that reducing this number of stalks to two in a hill, or 12,000 per hectare, will actually increase the yield of grain. It is nothing uncommon in parts of Luzon to

see the stalks so close together that there must be from 40,000 to 50,000 per hectare. It is no wonder the yield is small. Indeed, there is no possibility of it being anything else.

A little field was observed in Batangas Province the latter part of August, which had had some fertilizer applied to it before the corn was planted, which was on July 10. Even with this added encouragement there would be practically no corn produced, because there were about three times as many stalks on the field as the best of corn land would be able to support and make the proper yield of grain. The corn, aided by the stimulus of the fertilizer, had made tremendous plant growth, but was not able to make ears worth while. Just across the road, without fertilizer, and with only about one-fourth as many stalks for the same unit of area, was a good crop of corn.

The Filipino farmer wishing to grow corn can not be urged too strongly not to plant thickly. He will be the gainer in two ways: First, by using less seed, and second, by being very much more certain of a crop. (*H. T. Nielsen.*)

ONE BARRIO THAT IS FEEDING TWO MUNICIPALITIES.

In October, 1911, Mr. Ross Mathews was placed in charge of four stallions in the north of Catanduanes Island with station in the barrio of Bagamanoc, municipality of Viga. The drought had been so severe even at that early date that the people of the barrio were compelled to secure most of their vegetables from the other barrios of Viga.

Shortly after his arrival there Mr. Mathews brought the people together and through the influence of the councilmen and headmen the majority were prevailed upon to plant as much corn as possible. The result was more than could have been expected as this small barrio is able to sell large quantities of corn to the two municipalities of Pandan and Viga, aside from the amount traded with the traveling merchants that come from Lagonoy with fish and from Tiwi with pottery. The writer took occasion on his last visit to Bagamanoc to personally visit a great many homes and found in all a goodly supply of corn. Corn is practically the only cereal food used by the people. Where in other places they are pounding rice here they pound their corn and after sifting it cook it as they do rice. Some also is popped in a skillet and more yet is used by merely roasting it on the cob. The barrio of Bagamanoc was carried over the hard months caused by the drought by its abundant supply of corn all through the initiative of one man. The people have learned that rice is not an absolute necessity but can be replaced by other cereals.

Considerable damage is being done to the corn in the milk by the numerous rats. Entire patches were seen absolutely ruined. These were generally in sections surrounded by scrub growths providing a safe hiding place for the rodents. (*E. H. Koert.*)

MAIZE IN MULTIFARIOUS WAYS.

Now that the Philippines are really entering upon a new era of maize culture, it is well for us to look about and see how other countries regard this food plant. To go into a thorough discussion of this subject would require many pages, but a few of the less common uses may be worthy of mention.

Probably no country, outside of the European countries and the United States, uses a greater proportion of maize in its diet than Mexico. There the sound of tortilla making is heard throughout the land; really, during the first half of the day, the sounds made patting out the dough, i. e., the finely ground paste of the softened maize kernels, is heard in every Mexican pueblo; and by the same token, this tortilla is the commonest food of the people not only in the Mesa but also in the Tierra Caliente. Notwithstanding the belief that too much maize in a hot climate is not "good for the blood," it is the *pièce de résistance* of all classes of people even in the hottest districts of Mexico and Central America. After four years' experience with many varieties of tortillas eaten under all sorts of conditions—up at elevations of 3,000 meters and down in the suffocating jungles of the coast forest area—the writer has no hesitation in pronouncing the tortilla the best form of maize food, everything considered, that the world has ever used thus far. The appetizing taste of these thin, thoroughly cooked and very digestible cakes is very frequently varied by the addition of other material, such as beans, and spices such as "chile" (peppers) ; then, too, the varieties of maize, of course, must be considered; in fact no two batches of tortillas ever taste exactly alike since the degree of heat with which they are cooked, the amount of lime and salt used in the soaking or boiling waters, the degree of fineness of the paste, the thoroughness with which the hulls are removed—such apparently insignificant matters—all contribute to this splendid diversity of taste, smell, and even appearance.

Maize also enters into tamales, though to a lesser extent, and thereby hangs another pleasant tale.

Some of the less well-known maize foods are those of the Basques of northern Spain; these people use a moderate amount of maize and employ three or four distinct methods of preparation, some of which resemble the gofio of the Canary Islands.

If someone familiar with the uses of maize in northern Spain would be good enough to write up for publication his knowledge of the matter, the Philippine public would be greatly obliged, in my opinion.

Gofio is a common food in the Canaries and is made by roasting and then grinding the maize kernels. There are, of course, many varieties, some of which include wheat and barley meal, although the best gofio should have about 90 per cent of the maize meal. This food, which is said to be one of the best forms after the tortilla, has recently been introduced into Cuba, Porto Rico and the other parts of tropical America where the Canary Islanders have made their homes.

In Mozambique the writer has been obliged to fall back sometimes upon a Kafir ration when safari provisions were not in evidence; this food is a meal composed of ground Kafir corn, maize, and peanuts in about equal proportions; ground red peppers and sometimes ginger may be added to offset the rather indigestible quality of the mixture. It is carried in the basketwork knapsacks of the natives when traveling long distances overland and a handful of the food is considered sufficient for one full meal. The grains are more or less parched before grinding. If one could be quite sure of the cleanness of the substance it would be a fairly appetizing sort of emergency ration. Like gofio it may, of course, be mixed with hot or even cold water or milk to form a sort of paste or dough; this in turn could be fried or roasted as tortillas or cakes. (*O. W. Barrett.*)

THE WORLD'S BEST POMELO.

One of the most important recent introductions of the Bureau of Agriculture is that of the Siamese seedless pomelo, obtained from one of the Bureau's correspondents in Bangkok, Siam. Nearly everyone engaged in raising citrus fruit throughout the world has heard of this wonderful citrus fruit in Siam, and several attempts have been made heretofore to introduce it into other countries; however, largely on account of the inaccessibility of the district in which this particular variety exists, all efforts so far as we know, with the present exception, have failed.

Last April the writer had the pleasure of examining this famous fruit, and both in appearance and flavor the specimens were fully up to the high mark set by previous descriptions. This variety is probably the most free from seeds of any of the pomelos, or so-called "grapefruits," which are, of course, only varieties of pomelos. The shape, size and color of the fruit are also practically ideal.

After considerable correspondence the writer's efforts were rewarded on August 17 by the receipt of three mailing tins of budwood from Bangkok. On account of the packing material being somewhat too wet, a part of the budsticks had decayed en route; moreover, about half of the twenty-five buds which were inserted were killed by the very rainy weather which obtained at the time of the arrival of this material; several of the buds are certainly alive and two have started growing, thus making the introduction a success.

It is difficult to estimate the value of this fruit to the Philippines, but if the citrus industry develops here, as we hope it will, there is no question about this pomelo's taking the first rank in that group of citrus fruits. (*H. H. Boyle.*)

A NEW PHILIPPINE INDUSTRY.

In the December, 1911, issue of the REVIEW, the writer called attention to the possibilities of apiculture in the Philippines. Six colonies of Italian honeybees were ordered about the same time from Hawaii by the Bureau of Agriculture, and these arrived February 4 of this year on the U. S. Army Transport *Sheridan* on which they were placed January 13. The bees suffered considerably in transit, due evidently to faulty ventilation and only one hive contained 1,000 or more live bees on arrival. Two more had about 200 each, and one only about 100 bees; two colonies were dead. The five colonies were merged into two, but, notwithstanding this, they gradually died off till only one weak colony was left; this is slowly gaining in numbers now.

Undiscouraged by this result, some time ago, another order for six colonies was given to Mr. J. B. Thompson, in charge of the Guam experiment station. Mr. Thompson accompanied in person the five colonies that were sent to Manila and they arrived in good order August 1 on the U. S. Army Transport *Logan;* they are temporarily established at Singalong experiment station and seem to be pleased with their new home.

Apiculture, like most industries, had its inception and development in the Temperate Zone, yet it finds its best application in the Tropics and subtropics. Owing to the fact that the continued summer gives the insects the opportunity to work the entire year with no need of storing supplies for a long winter, the year's gain of honey and wax, if the apiary is well located, is far greater in the Tropics than in the Temperate Zone. While the writer holds out no such dazzling hopes to the would-be Philippine apiculturist, it is worthy of note that the world's record for honey production is held by the subtropical state of

Florida. The one hundred and three colonies of an apiarist there, known to the writer, averaged 135 kilograms of honey per colony one year, and one produced the astonishing amount of over 225 kilos. The finest flavored honey in the world is, by the way, produced by a tropical leguminous tree, the logwood, *Hæmatoxylon campecheanum,* recently introduced into the Philippines. In this connection it might be mentioned that the exportation of beeswax gathered in the woods from the wild bees is a not an inconsiderable item in the export products of Mindanao. (*P. J. Wester.*)

SOIL PREPARATION.

One of the prime essentials in the raising of crops is good preparation of the soil before the crop is planted. The desirability and advantage of this previous preparation is less noticeable on irrigated land, especially in rice growing, than where rainfall is depended upon for the water supply.

In a recent trip into Batangas Province, two pieces of upland rice were observed which illustrated the value of improving upon the present methods of soil preparation. In this trial one piece of land had been plowed deep and carefully with a "Luzon" plow, the other with a native plow. The rice on the deeply plowed ground was easily 50 per cent better in appearance than that on the piece prepared in the ordinary way. So pronounced was the difference in appearance, that the owner of the land declared he would do his future farming with plows of the "Luzon" type.

There can be no doubt that the use of the better plows would add greatly to the products of the Islands, even if no more land were brought under cultivation. Such increase would be still larger if the work stock were used in teams of two or even four animals, and the plowing be good and deep, 15 to 20 centimeters, and the further preparation needed consists of working the surface with disk and smoothing harrows until planting time. In the United States a farmer without a disk harrow is seriously handicapped in preparing land for any kind of crop.

Plowing, when done well, is an expensive operation: The use of the disk harrow is more economical for final preparation before seeding, and adds greatly to the farmers returns by diminishing the cost of production, and also increasing the size of the crops produced. This is one of the easiest and simplest methods by which the Filipino farmer can improve himself, and he should not be slow to avail himself of the method. (*H. T. Nielsen.*)

THE PRESENT RICE CROP.

From observations made along both lines of railroads leading out of Manila, the area of rice planted this season appears to be greater than ever before. So far the crop has not been damaged on account of weather conditions and the prospects for an abundant harvest are good. (*C. M. Conner.*)

THE BEGINNING OF THE NEW COPRA EPOCH.

At last the tide of public opinion is setting so strongly against the reprehensible methods of the Filipino copra maker that evidences are now to be found, by even the casual observer, which indicate that the day of scorched and rotten copra is passing.

It appears that there is a renewed interest in the abominable *tapahan*, or rather in the kind of fuel which should be used therein. The Philippine *tapahan* owner usually employs both the "cascaras," or shells, and the "bonote," or husk, as fuel for his fire (not to say *smoke*-chamber), the quality of some of the "bonote" being extremely poor, i. e., so green and wet that in burning it produces much steam and smoke though but little heat.

There is a movement on foot now—not emanating from this Bureau—with the object of inducing the small planter to use only shells in his *tapahan*. This idea is, of course, good so far as it goes, but the only way to prevent smoking the copra in the *tapahan* is to provide a metal, or possibly matting, sheet to slide underneath the floor or lattice-work supporting the copra, as advised in THE PHILIPPINE AGRICULTURAL REVIEW (May, 1912, p. 267). This could be kept under the copra while the smoke from the husks and shells is passing off by flues or some sort of a wide chimney at one end of the structure; as soon as the bed of clean coals is formed with practically no smoke rising therefrom, the sheet or tray may be withdrawn, thus exposing the copra to the direct heat of the coals. This process, of course, can not turn out absolutely smokeless copra, but it would in a large measure reduce that objectionable feature.

The most encouraging news in this connection, however, is the fact that in Laguna two plants have recently started with steam-heat dryers; this machine, planned by a Filipino planter, is a modification of the drier operated by the Bureau of Agriculture during the First Philippine Exposition. The sides of the drying ovens are properly made of wood instead of metal and the steam pipes are laid under each tier of trays instead

of being massed at the bottom. These plants are turning out A No. 1 copra in about ten or twelve hours from the charging of the trays; having arrived deplorably late in the Philippine economy they are, of course, running night and day now; two to do the work of 2,000! The steam pressure is kept low in order to keep the temperature down to about 50° or 60° (130° or 150° F.), i. e., to prevent releasing any of the oil in the copra. The boiler is of a simple type and the fuel is anything from wood to half-dried coconut husks. The principal point is that it works just as well during a rainy day as at any other time; and furthermore copra, which has been partly dried by *tapahans* in the vicinity and which is beginning to rot, can be saved—though, of course, not as A No. 1 material—by putting it in the driers for a few hours.

On a recent inspection of one of these plants the writer noted that a large proportion of the unhusked nuts that were being delivered to the factory were not only not cured but were even quite unripe and a considerable number were positively green: this spells a very considerable loss not only to the planter but also to the one who attempts to make good copra out of a raw material which must needs have a very low oil content as compared with that from cured, ripe nuts.

By the way, at least three firms in Manila seem to be contemplating the wholesale manufacture of copra driers for small or average-sized plantations; the Bureau of Agriculture has been consulted in each case and certain features have been advised and suggested which will, we believe, make for meliorism. (*O. W. Barrett.*)

THE CALIFORNIA NAVEL ORANGE IN THE PHILIPPINES.

Since the American occupation of the Philippines, several varieties of the citrus fruits cultivated in Florida and California have been imported into the Archipelago. However, many of those who have made these introductions have had more enthusiasm than knowledge about the subject and others have been little more than transients, with the result that their plant-introduction work has been lost and few introduced varieties have in consequence as yet fruited in the Philippines.

In February, 1910, Mrs. M. L. Sawyer, of Manila, imported several citrus trees from California, among which were some navel oranges. Doing poorly at first, the trees, after adjusting themselves to Philippine conditions, have made a very satisfactory

growth and one tree produced several fruits this year. The fruits ripened in September and a specimen was presented to the Bureau for testing. The transformation in the navel orange caused by its transportation to the Tropics is so great that few of its California friends would recognize it. It is of good size, the skin thin and "silky," and the flesh is juicy enough to satisfy the most exacting; the acidity of the California-grown fruit has here been changed to an almost excessive sweetness; with a trifle more sprightliness this Philippine-grown navel orange would be a fruit unsurpassed in quality. Budwood of the variety has been presented to the Bureau by Mrs. Sawyer and budded trees will be distributed in due time to applicants. (*P. J. Wester.*)

COOPERATIVE DEMONSTRATION WORK.

There are very many views as to the best manner of carrying on coöperative demonstration work. The conditions most certain to bring success are when a particular community becomes sufficiently interested in the improvement of farming to request aid in carrying on demonstration work. Another way that is very good, and practically sure of getting results, is to work a given community intensively. Four or more farmers, each of whom is naturally inclined to want to be considered as raising the best crops in the neighborhood, are selected, and each is encouraged to take up some coöperative work with the idea of making his position as the best farmer secure.

The various coöperators may all work on the same crop, each one attacking some special feature. The object is to secure a healthy rivalry in getting results. This class of coöperative work requires care and tact in arranging, but is not especially difficult. The writer once carried out such a coöperative test that was very successful. Cowpeas was the crop under trial. There were such divisions of the work as varieties, time and rate of planting, previous preparation of the land, cultivation or no cultivation after planting, and others. The object sought was to see which man could produce the largest, and at the same time most profitable crop. The entire neighborhood took an interest by the end of the season, and much of value was learned by all. Similar trials with rice, corn, mungo, and other crops might be carried on in the Islands to the advantage of all concerned. The especially strong feature of this plan is in being able to get information on so many of the factors affecting the crop under consideration, without putting too much of a burden on any particular individual. (*H. T. Nielsen.*)

AN INVITATION TO OUR READERS.

The distribution, or, strictly speaking, the localization, of some of the most common Philippine fruits and vegetables is a very interesting subject; for instance, even some of the most common fruit species like the mango, chico, mabolo, tamarind, etc., are limited to certain more or less circumscribed areas.

Certain fruits, such as the Durian, Mangosteen, Baúno, and Marang, are of extremely limited distribution, some evidently never having been taken outside of their native habitat, while a study of their natural environment assures us that they can be grown in many other parts of the Islands where they are now unknown.

The Bureau of Agriculture, in an endeavor to remedy this defect, is now trying to assemble a collection of all Philippine fruits and vegetables, in order to study their habits, requirements, and uses, with the view first of improving them and second, of distributing them to the municipalities where they are not cultivated.

In order to assist the Bureau in this work the Philippine readers of THE PHILIPPINE AGRICULTURAL REVIEW are cordially invited to communicate with the Bureau relative to any useful plants growing in their respective municipalities; the absence of any fruit or vegetable that would be desirable to introduce there should likewise be noted. The Bureau will endeavor to supply seeds or plants of such species to any municipality where they are not now found.

Readers in foreign countries are also invited to communicate with the Bureau with the object of exchanging seeds and plants. All communications should be addressed to the Director of Agriculture, Manila, P. I. (*P. J. Wester.*)

THE NE PLUS ULTRA OF COCONUT RECIPES.

Partly on account of the deplorable scarcity of green coconuts in the Manila markets, the Manila housewife is seldom able to use any but the "dry" coconuts in her menage. In other countries, however, the value of the various forms of coconut foods is better appreciated than in the Philippines; in the West Indies, in particular, this delicious fruit, or nut as some prefer to call it, is very much in evidence.

A recipe which appears to be the best we have ever had the pleasure of seeing has been given by Mrs. Hamilton King, of Bangkok, Siam, and is obviously deserving a trial by every Philippine housewife. We take the liberty of quoting verbatim:

Coconut custards served in "shells."—Six small coconuts. Trim off the

outside green part. Cut off a small slice at the bottom, so the coconut will stand; and cut a piece across the top—leaving enough of the fiber to act as a "hinge" for the cover. Over the grated meat of one large, rich, ripe coconut pour the liquor, or "milk," of three green coconuts, press hard, and strain. Add eight eggs well beaten and six teaspoons of thick condensed milk (as you take it from the tin). Sweeten to taste with palm (or *brown* in the Philippine Islands) sugar that has been rubbed smooth with a little of the coconut "milk." Pour this mixture into the coconut "shells" and steam over *slowly* boiling water about one hour, being careful not to cook them long enough to make the custard "curdle." Serve these with thin wafers or "kisses" or any kind of cake preferred.

(*O. W. Barrett.*)

THE PRESENT LOCUST SITUATION.

In view of the amount of damage done to the agricultural interests of these Islands in former years, the Second Philippine Legislature amended Act No. 817 of the Philippine Commission by passing in February, 1912, Act No. 2121, which changed the method of appointment of the Locust Board for each province, defined the relation of the Bureau of Agriculture to the locust boards, and appropriated the sum of ₱50,000 for locust destruction. This fund is to be expended under the rules and regulations prescribed by the Director of Agriculture.

Up to the present date reports of infestation have been received from twenty-three provinces. The extraordinarily dry season has been very favorable for locust development and the pest has appeared in more than usual numbers. The damage done by the locusts is not confined to the nymph or hopper stage—in fact greater damage is sometimes done by the large swarms of flying adults. These latter can easily travel 15 kilometers a day and, unless hurried or worried by the weather, destroy almost everything in the line of crops in their path.

As was expected, the outbreaks have been more numerous and severer in the southern islands than in Luzon. Samar, Leyte, Cebu, Bohol, and Mindanao are the scenes of the worst attacks. On the Islands of Cebu and Bohol it is estimated that about 40 per cent of the corn crop has been destroyed, while immense damages to coconuts and bamboo have also been in evidence. In many districts bamboos have been completely defoliated and the weight of the insects has even broken them. The coconut palms, especially along the east coast of Cebu and the west coast of Bohol, are defoliated and the crowns frequently broken; it will take at least two years before these injured palms will be in full bearing again.

In combating the pest, the destruction of eggs and hoppers is

the most effective measure. The flying locusts are very difficult to combat, but by the use of nets in localities where they are feeding, considerable numbers may be caught and destroyed. By plowing areas where eggs have been laid, a large part of them are either crushed or buried so deeply that the young hoppers can not emerge. As the Filipino plows do not turn a good furrow, but simply loosen the ground, it has been found necessary to use a roller, or to tightly pack the ground by use of hand mauls.

The pit system for the "hoppers" is most effective; by the use of corrals of sheet iron or other materials they can be driven into these pits where they are easily destroyed. Up to August 15, 7,700 cavans [1] of locusts had been destroyed in Bohol and at least 10,000 cavans in Cebu. The outbreaks in Luzon are confined to the district where the Provinces of Tarlac, Pangasinan and Nueva Ecija meet. Swarms have been reported from Vigan, in Ilocos Sur; Santo Niño, in Isabela; Iguig, in Cagayan; Floridablanca, in Pampanga; Bato, in Albay; Milagros, in Sorsogon; San Jose, in Ambos Camarines; and Batangas, in Batangas.

The southern islands, Cebu and Bohol, are almost completely infested. Leyte has had two severe outbreaks, Samar, six; Occidental Negros, one (official, and several presumed); Oriental Negros, six; and Mindanao, ten.

Act No. 2190 was enacted September 17, 1912, by the Philippine Commission, to amend Act No. 2121 of the Philippine Legislature, making the latter applicable to the "territory inhabited by the Moros or other non-Christian tribes." This Act appropriates ₱5,000 for carrying on locust destruction work in that territory. (*C. R. Jones.*)

BANANA PRODUCTION IN COSTA RICA.

In several parts of Central America and the West Indies the production of bananas for exportation to the United States assumes considerable importance. In Costa Rica, for instance, 40,000 hectares are planted to bananas and the monthly crop from this area ranges between 700,000 and 1,200,000 bunches, the cost of cultivation, harvesting, and preparing the crop for the market being about ₱400 per hectare. (*P. J. Wester.*)

SEEDS IN THE MOUNTAIN PROVINCE.

It is worthy of note that among the various out-of-the-way places to which collections of garden seeds have been sent by the Bureau during the past season, one of the most interesting from

[1] 1 cavan equals 75 liters.

the vegetable grower's point of view is Cervantes in the Mountain Province.

Although the dry season was, of course, very severe even in that district, such difficult varieties as New Zealand spinach, Lima beans, and turnips came through remarkably well. Tomatoes, eggplants, and radishes, of course, gave excellent returns. The Igorots are becoming greatly interested in maize, legumes, and grain sorghums; an effort will be made during the coming season to assist them to increase the number of varieties in their gardens and paddies, and especially to introduce citrus fruits, pineapple varieties, mangos and other fruits adapted to that district. (*O. W. Barrett.*)

ERRATUM.

Through an error, the name of the orchid, illustrated in Plate IV, Volume V, No. 9, of THE PHILIPPINE AGRICULTURAL REVIEW, English edition, was omitted. The name of this plant is *Grammatophyllum multiflorum* Lindl.

114131——4

BOOK REVIEWS.

"COCO-NUTS, THE CONSOLS OF THE EAST."

By O. W. BARRETT, *Chief, Division of Horticulture.*

This Bureau has just received an important work bearing this title, by H. Hamel Smith and F. A. G. Pape.

The volume contains over 500 pages of very interesting matter on all branches of the coconut subject from selection of the seed to handling the finished products. The illustrations are numerous and well selected. It is published by the "Tropical Life" Publishing Department, of 83–91 Great Titchfield Street, Oxford Street, W., London, and sells for 10 shillings net (11 shillings postpaid). An important feature of the work is a foreword by Sir W. A. Lever, Bt., one of the world's leading authorities on oil products; there is also an interesting introduction on "Health in the Tropics," the substance of which every estate manager should thoroughly familiarize himself with.

A whole chapter is devoted to coconut planting in the Philippines; our Bulletin No. 17 is freely drawn upon and Messrs. Copeland, Worcester, and Lyon are also quoted to a considerable extent; the five interesting illustrations on copra making in the Philippines are among the best in the book. At the close of the work is a chapter on copra drying machinery and here Mr. Smith puts forward his ideas on both his Rotary Oven Dryer and his more recent plan for a large drying house using strong ventilating fans to force the air up through the several stories or floors of latticework. Moreover, there is an up-to-date chapter on the extraction of oils; and the various methods from the primitive "chekku," or camel mill, to the "Scott" Patent Solvent Extraction Apparatus are described. The extraction of fiber, of course, has its due space and even estate irrigation is discussed. Machinery for clearing new ground, for spraying palms of all sizes, and for modern-style estate cultivation, is fully described. A chapter on mulch by the writer is quoted intact from "Tropical Life" for February, 1910.

"SOIL FERTILITY LABORATORY MANUAL."

(Ginn and Company.)

By H. O. JACOBSON, *Agricultural Inspector.*

This textbook has been compiled by Cyril G. Hopkins, professor of agronomy, and James H. Pettit, assistant professor of soil fertility, both of the University of Illinois.

The volume is an outline of the practices evolved in ten years of experience in conducting classes in the study of soil fertility.

Most of these practices have originated at the University of Illinois; the other specific chemical directions are commonly based on those adopted by the Association of Official Agricultural Chemists.

The practices outlined cover the ground completely in ordinary analytical work with soils, feeds and fertilizers. The methods employed are those which embrace economy, speed, and accurate results. A large number of blank pages are interspersed in the book, making it possible to place permanent notes where they will be most convenient and useful.

The volume is concise, up-to-date and practical and can be recommended to students and teachers as one eminently suitable for their needs.

The listed price of the book is ₱1.20.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

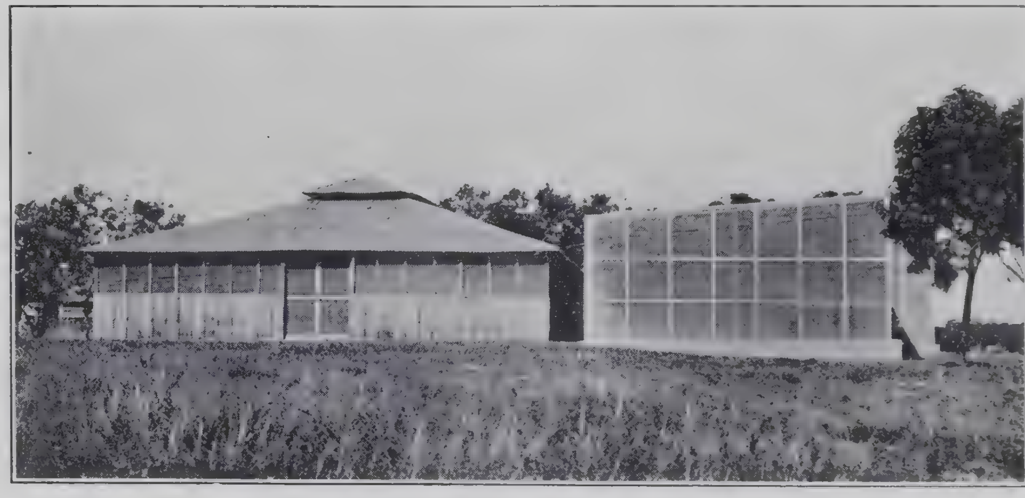
By the DIRECTOR OF THE WEATHER BUREAU.

AUGUST, 1912.

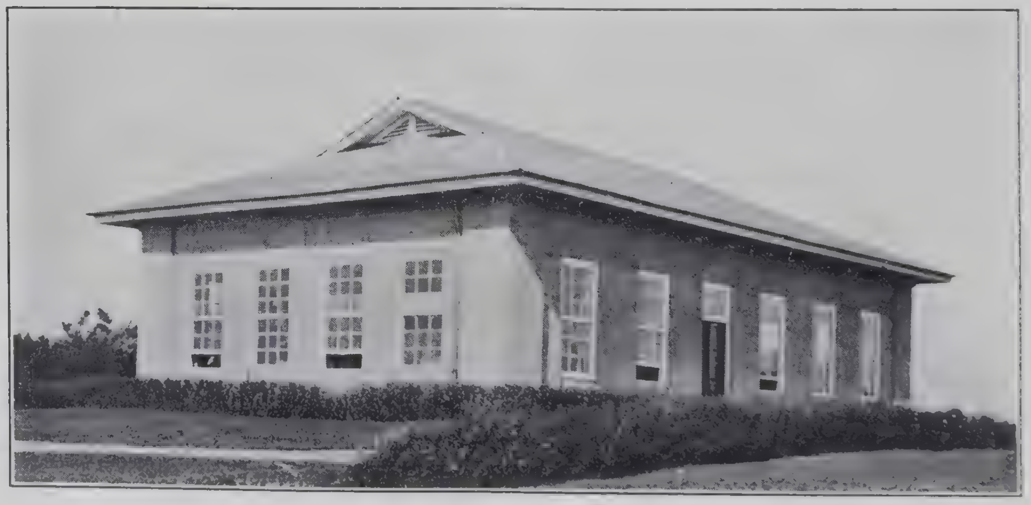
[Temperature and rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	26.9	-------	27.7	-------	27.3	1.3	23.6	65.8	24.2	60.1	24.4	116.5
2	27.3	-------	27.3	-------	26.8	34.3	24.8	30.2	25.6	4.4	25.3	81.3
3	26.8	15	26.8	-------	26.9	13.7	26.4	9.4	26.8	1.5	25.1	8.1
4	25.6	-------	27	-------	25.9	.8	26.2	-------	27.2	1.8	27	2
5	27.1	-------	26.9	4.8	26.3	10.9	27.4	-------	27.8	-------	27	50.3
6	26.6	7.1	27.4	1	26.6	-------	25.8	18.1	27.8	-------	27.2	26.7
7	26.5	1	26.7	26.7	26.2	-------	27	24.4	28	-------	26.6	.3
8	25.3	17.6	26.1	7.9	26.5	1.6	27.8	-------	27.6	27.2	27.2	17.8
9	25.1	-------	26.2	16.2	26.3	-------	28.2	22.1	27.4	3.3	26.8	9.7
10	25.8	48.8	25.4	8.6	27.4	-------	27.8	4.8	26.1	15.5	26	67.1
11	26.5	5.1	27.3	1.5	26.9	6.1	27.2	9.9	25.1	55.7	26.3	47.7
12	26.5	12.7	27.6	-------	26.2	36.1	26.8	3.3	25.2	8.9	27	7.4
13	26.3	14.3	27.8	-------	25.5	131.1	27.9	8.2	27	3.3	27	12.2
14	27.1	15.7	27.6	2	25.4	38.1	26.8	4.4	27.4	6.4	27.4	-------
15	27.3	1.3	27.5	3	27	2.8	27.8	15.3	27.2	1.8	28.2	20.8
16	27.9	-------	26.9	1.3	26.7	10.1	27.8	30.5	27.4	-------	27.4	2.3
17	27.4	2.5	28.1	1.5	26.6	3	28.2	12.7	27.6	-------	26.2	59.7
18	26.6	1	27	-------	27.4	-------	27.6	.5	27	5.3	25.8	7.6
19	26.2	13.7	27.1	39.4	26.8	-------	29.1	8.4	26.7	-------	27.2	33.8
20	25.9	42.6	26.6	19.5	27.5	-------	29.2	1.5	27.8	-------	28	66.8
21	26.6	.3	27.1	-------	26.7	-------	28	2.8	28	-------	27.3	8.9
22	26.1	27.5	26	48.2	26.4	11.6	27.6	-------	28	-------	27.8	36.1
23	26.3	.5	27.4	1.3	26.3	3.8	27.6	13	28	3.8	27.2	3.8
24	25.6	36.3	27.3	-------	26.6	-------	27.5	7.6	27.8	1.5	27.4	37.1
25	26.4	5.8	28	-------	27.4	3	27.1	9.7	26.1	3.1	27	19.1
26	26.2	23.3	29	-------	27.1	82.3	26.5	7.4	27.2	-------	27.1	5.1
27	26.9	4.6	29	-------	26.5	27.7	26.1	16.5	27.6	-------	27.8	13.7
28	27.3	1.8	29.8	-------	26.2	38.1	27	14.4	27.6	-------	27.3	19.8
29	28.2	-------	29.5	-------	27.2	2.3	26.4	16.2	28	-------	26.2	64
30	27.8	-------	29	-------	28	-------	25.1	50.7	26	.8	24.2	128.6
31	27.1	17.2	29.1	-------	28.1	77	24	40.4	26.6	-------	24.2	72.6

(*a*) Group of sheds for general experimental work—operating room and screened stalls in wing on left.



(*b*) Screened shed and cage used for experiments in veterinary entomology.



(*c*) Main laboratory building.

PLATE I.—VETERINARY RESEARCH LABORATORY AT ALABANG, RIZAL.

VETERINARY NUMBER

THE PHILIPPINE

Agricultural Review

VOL. V DECEMBER, 1912 No. 12

CONTENTS AND ILLUSTRATIONS.

CONTENTS.

ILLUSTRATIONS.

TEXT FIGURE.

EDITORIAL.

THE ANIMAL-DISEASE QUESTION.

By the DIRECTOR OF AGRICULTURE.

This editorial is intended to be a plain statement, in language that any one may understand, of the present status of the animal-disease question, with special reference to rinderpest, and of the methods employed in fighting disease, and why they are used.

No one seems able to say just when or how rinderpest was introduced into the Archipelago, but at the time of American occupation it was here and has been present ever since.

In 1902 occurred a scourge in the way of a devastating epizoötic of the disease which, according to the census of that year, wiped out forty-three per cent of the cattle and carabaos of the Islands, leaving 829,567 remaining. Since that time the Bureau of Agriculture has been waging warfare against rinderpest, various methods having been used, and various results attained. The use of serum has been followed, and then, as a general measure, dropped. The reason for this is that the serum only confers a temporary immunity from the disease, not averaging over three or four weeks. The expense is considerable and the results not commensurate.

Simultaneous inoculation has been used to a slight degree as a field measure, but that is an expensive operation, and accompanied by many fatalities. In fact every known plan has been tried, with the result that practically the entire dependence in the fight is now upon quarantine. No one can doubt that segregation and quarantine would, if universally and rigidly applied, entirely eliminate the disease in a very short time.

The number of cattle and carabaos in the Islands is increasing at the rate of 15 per cent per annum according to the semiannual enumerations made under an executive order, and there were reported 1,090,675 cattle and carabaos in the Islands on July 1, 1911. Add 15 per cent for the past year and we read 1,254,276. Animal lists made by representatives of this Bureau in connection with the rinderpest campaign warrant the conclusion that there are at least twenty per cent more animals in existence than are reported by municipal presidents. This would indicate the existence in the Islands at this time of a little over one and a half million cattle and carabaos.

The present rules and regulations are made and enforced to protect the animals now on hand, with the knowledge that in a very few years the supply will be entirely sufficient to meet every need for work and for food, provided, always, that the disease in the country is kept in check or reduced, and no new infection brought in.

The number of municipalities infected with rinderpest was, during the fiscal year ending June 30, last, cut down, by means of the methods now employed, from sixty-four to thirty-four and has been further reduced to eighteen at the present writing. That it is slowly but surely approaching the vanishing point, we sincerely trust. The number of animals dying from the

disease is now negligible, being not to exceed five head per day reported for the entire Archipelago.

The Bureau of Agriculture proposes to fight along the lines that have been so successful during the past year, and thus expects to deserve the approbation of the several hundred thousand owners of cattle in the Islands.

The numerous attacks of those financially interested in bringing in cattle, regardless of whether or not they are free from disease, have been and will be fought to a finish again, if necessary, in order that the hundred million pesos investment in this class of live stock may be protected.

The Director and various members of his staff have been sued, injunctions have been sought, and every possible attempt has been made to break down the quarantine now in effect. These attempts have all been futile, and, should future attempts be made, they will be fought as part of the day's work of the Bureau. The officials of the Bureau of Agriculture appreciate the great responsibility resting upon them in this matter and do not propose to swerve a hair's-breadth from the safe and sane methods necessary to stamp out the disease, no matter how loud the complaints of those who are willing and anxious to bring in stock from dangerous territory.

In the last year and a half that cattle and carabaos were admitted from the ports now quarantined, 85 per cent of the shipments were infected with either rinderpest or foot-and-mouth disease, or both, when they arrived in the Philippines.

The Bureau of Agriculture proposes to continue to stand like a stonewall against the importation of disease when it could by any possibility reach the animals of this country. The law places that responsibility on this Bureau and it does not propose to shirk it. On the other hand, the people may rest assured that their interests will be protected in every possible way.

THE CAMPAIGN AGAINST RINDERPEST.

By Archibald R. Ward, *Chief Veterinarian.*

Rinderpest is a purely contagious disease, that is, it is propagated primarily by transmission from animal to animal. While the objects contaminated by the discharge of sick animals seem to retain their infectivity for relatively short periods, there is no evidence that rinderpest infection lingers for months in any place except as transmitted by living animals. The disease apparently is totally unlike those in which the germ causing the disease lives in the soil and from thence is transferred to the animal. Anthrax, blackleg, and tetanus (lockjaw) may be mentioned as examples of such diseases which are totally unlike rinderpest in manner of spread. Furthermore rinderpest does not display evidence of being transmitted by insect carriers, as are such diseases as surra, yellow fever, Texas fever, malaria, etc. The determination of the peculiarities of the disease with reference to the foregoing points is a matter of the highest importance in determining the methods to be employed in combating it.

The spread of rinderpest is inseparably associated with cattle movement and contact between the healthy and the sick by means of which the virus of the disease is spread from one animal to another. The disease persists to-day where herds of cattle roam and intermix freely or where the customs of the people favor the mixing of animals. It has long ago disappeared from western Europe and Great Britain where range conditions no longer exist and where an enlightened public policy prevents its possible reintroduction in animals from countries where the disease exists. In this connection it may be observed that the disease has never yet invaded the Western Hemisphere nor Australia.

In rinderpest we have the most destructive, and, during certain periods, the cattle plague most commonly known to mankind. At one time or another it has swept Europe, Africa, Asia, and

outlying islands. Invasion by the disease has constituted national calamities, the problems connected with which have taxed the professional and administrative ability of the wisest.

The intimate association of the spread of rinderpest with cattle movement indicates the measures to be employed against it, such as the restriction of the movement of bovine animals by quarantine and particularly the discovery and isolation of the sick and exposed at the earliest possible moment.

In the present campaign particular effort has been made to ascertain the peculiarities of rinderpest in the Philippines by study of the disease in the veterinary research laboratory at Alabang. Experiments have shown that the period during which an animal is capable of spreading disease to others is short and that this period of infectivity takes place for the most part before the owner would recognize the animal as diseased except by the most thorough scrutiny. Observations made in the Philippines and elsewhere particularly emphasize the fact that there may occur mild cases of the disease in which the slight symptoms present could escape recognition as those of rinderpest. The disease may require as long as ten days before developing in an animal after exposure, so after the first discovery of infection other cases may be expected, during that time, among animals that have been in immediate contact with the sick ones irrespective of whatever measures of separation that have been enforced in the meantime. These considerations forbid permitting freedom of movement to apparently healthy animals, requests for which are repeatedly made by stock owners.

The measures of vital importance in combating rinderpest consist of separation of animals in an infected locality and the detection of the sick ones among them. Isolation checks the disease by preventing further contact and consequent possible infection of the healthy. Nevertheless the success of isolation measures is menaced by the possibility of indirect contact between the sick and the healthy through the medium of contamination of water supply, of men and of small animals coming in contact with each in spite of their direct isolation.

There are many obstacles in the way of accomplishing perfect isolation of animals largely due to the violation of quarantine measures by owners. Animals in the Philippines are customarily pastured together and the interdiction of the use of the common pasture necessitates the owners cutting grass or otherwise feeding the animal in lieu of the customary pasturing. The habit of the carabao of wallowing in mud puddles or streams is imperatively necessary and in its place the owner must neces-

sarily carry water to wet the animal, but by far the greatest obstacle consists in the necessity for the use of carabao and cattle in tilling the soil and moving crops to market. Animals used for traction follow the roads and this animal movement is comparatively easily controlled in a quarantined area. In addition, however, there is in the Philippines an extensive movement of animals bearing packs, or those for sale, or those being transported from one district to another to plow. These may move without reference to roads or even the numerous trails, inasmuch as there are few fences to restrain them.

Of equal importance is the discovery and isolation of animals infected with rinderpest. Suspected cases are kept under observation until the diagnosis is confirmed, after which the animals are placed in a corral where they are held until fifteen days after apparent recovery. It is impracticable to slaughter the sick on account of the cost of reimbursing the owners and it is further believed that no harm results in keeping the sick in isolation under the conditions provided. There is a slight advantage in that in some districts as many as 40 per cent of the animals recover. Inasmuch as they are immune to further attack they constitute a permanent asset to the country. The slaughter of the sick would increase the opposition of owners and make the discovery of cases even more difficult. Under most conditions animal movement is so free that the determination of animals that have been in actual contact with the sick is impossible and consequently their slaughter is quite impracticable. Furthermore these contact animals, even if known to have been associated with the sick, may be immune, in which case their slaughter would be worse than useless. Under conditions in which the number of sick and exposed susceptible animals could be accurately known, undoubtedly the best measures would consist in the slaughter of all of them. Such conditions as these exist most frequently in Europe and the United States.

A measure of great importance in a campaign is the collection of accurate data regarding the animal population and its location, without which, effort to control the movement of animals would be futile. One of the first tasks in a campaign is to compile these data with reference to name of barrio, municipality and province; owner's name; caretaker's name; carabao or cattle with sex, municipal brand, owner's brand, registration number, date of issue of ownership certificate and the date of compilation of the census. Where the disease does not actually exist, the time of inspectors, when not employed in investigating reports of disease, is spent in compiling this information to be

in readiness when needed. The opposition of owners to quarantine measures results in their failing to report cases, therefore the task of the Bureau of Agriculture does not merely consist in fighting rinderpest but in discovering it. Thus a constant system of inspection is necessary in which is employed the animal census to which reference has already beeen made.

The Bureau of Agriculture carries on the campaign against rinderpest with a force which, on June 30, 1912, consisted of 44 veterinarians, 64 American live-stock inspectors, and 223 Filipino live-stock inspectors. On that date there were also on duty 30 officers and 1,390 enlisted men of the Philippine Scouts, as well as 6 officers and 147 enlisted men of the Philippine Constabulary. These military organizations coöperate with the Bureau forces as quarantine guards and perform other duties incident to the campaign. Owing to the reticence of owners to report disease the Bureau regards the progressive search of a given piece of territory for the disease as of equal importance with the combating of existing disease, inasmuch as the aim of the campaign is the extermination of all infection. In supposedly clean territory which is being searched for disease all bovine animals are tied up for a period of ten days during which time a complete census is made as well as daily inspections. During this period passes for animal movement are given only under the most exceptional circumstances. Following this period a systematic triweekly inspection is continued for a variable period but interferes but little with the use of the animals for tilling the soil. However, they are not allowed to pass from one municipality to another during this period.

Upon discovery of infection the barrio in question is placed in quarantine. Exit of animals therefrom is prohibited and they are kept in isolation, being fed by the owner rather than by grazing. Until the expiration of twelve days no permits for animal movement of any kind are issued, but after this, in cases or urgent necessity, plowing may be permitted if the animals are kept on the piece of land in question.

The enforcement of the quarantine is effected by quarantine guards, moving as patrols day and night. The continuous inspection of the animals in the district and the neighboring ones is effected by the inspectors of the Bureau of Agriculture or by members of the Scout organization.

The construction of a corral for the sick animals is one of the first requirements. This is provided at the expense of the municipality. There is chosen a site well isolated from public roads and animals, care being further exercised in respect to

restraint of drainage therefrom to prevent conveying infection to other animals.

The corral consists of an inner square, provided with abundant shade, and an outer enclosure, all of bamboo, and designed to exclude small animals. Between these two is a strip in which the dead are buried. Around the whole of the inner inclosure is a deep ditch to obviate the danger of transmission of infection by flood water. All refuse is deeply buried within the inclosure. The frequent use of disinfectant minimizes the danger of transmission of infection therefrom. The caretaker, an employee of the municipality, attends the animals, receiving the fodder from the owners who come to the outer fence, but are not allowed within. Access to the enclosure is limited to those having business therein and the strictest precautions are taken to prevent the carrying out of infection on shoes or on any article such as ropes or baskets. Sick animals are kept in this corral for fifteen days after apparent recovery.

The quarantine in the barrio is maintained for thirty days after discovery of the last case of rinderpest. In connection with this work the following forms are employed:

NOTICE OF QUARANTINE.

To .... Address ....

Location of quarantine ....

You are hereby notified that the .... head of .... are placed in quarantine in accordance with provisions of paragraph (A), section 6, Act 1760 of the Philippine Commission.

That these animals are not to be removed from the above address without written permission of the Director of Agriculture.

(Signed) F. W. TAYLOR,

Director of Agriculture,

By ....

Inspector.

Received ....
(Owner or agent.)

...., 191 .

[In triplicate.]

"TIE UP" ORDER.

.................................., 191
(Date)

The President of ....

You are hereby notified that a contagious infectious disease of .... known as .... exists in the barrios of ....

.... in your municipality and you are requested to have all of the .... in these barrios tied up separately at the houses of their respective owners until released by a Veterinarian of the Bureau of Agriculture.

Very respectfully,

....

Supervising Veterinarian.

(To be issued in triplicate; one copy to be retained; one to be handed to the president, and one forwarded to this office.)

INSPECTION ORDER.

...., 191
(Date)

The President of ....

You are hereby requested to have all of the carabaos and cattle in the barrios of .... tied at the houses of their respective owners on the following dates: .... for inspection.

Very respectfully,

....

Supervising Veterinarian.

(To be issued in triplicate; one copy to be retained; one to be handed to the president; one forwarded to this office.)

PASS FOR WORKING ANIMALS.

Municipality of .... Date ...., 191

Permission is hereby given to Mr. .... in the barrio of .... to work .... This animal is to be kept at .... when not working and is subject to inspection at all times.

Brands.	Sex.	Age.
....		
	....	....
....		

This pass may be recalled at any time and must be carried by the man working the animal.

....

Supervising Veterinarian.

(To be issued in duplicate, one copy for owner; duplicate furnished Scout officer in charge.)

(Certificate of ownership will be presented by owners and held by the veterinarian in charge until pass is taken up.)

WEEKLY MUNICIPAL RINDERPEST REPORT.

.............................., ..., P. I., ..., 191

Barrio.	Cases from last week.		New cases.		Deaths.		Released.		Remaining at end of week.	
	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.	Carabaos.	Cattle.
Total for town.......										

Number of cases in court during week: Pending .... Disposed of ....
Names of barrios placed in quarantine: ....

....

Names of barrios released from quarantine: ....

....

Names of employees on duty in town: ....

....

....

REMARKS: ....

....

....

For week ending Saturday, ..., 191

(Sgd.) ....

Adequate means for combating the disease were first made available by the generous public-spirited action of Major-General J. Franklin Bell, commanding Philippines Division, who, on the request of the Governor-General of the Philippine Islands, promptly assigned Philippine Scouts to the rinderpest campaign. His determination to win, but without unnecessary friction with the people, likewise permeates the rank and file of the organization. The enthusiasm, patience and tact of the officers have been an important factor in producing the results obtained.

The Commanding General, Philippines Division, assigned the general supervision of Scouts on rinderpest quarantine duty to Capt. Peter W. Davison, aid-de-camp. He worked directly with the Bureau of Agriculture in all details involving Scouts so as to carry on the campaign in accordance with the plans of the Bureau.

Maj. W. R. Sample, U. S. Army, was assigned directly in charge of the first troops engaged on this work and perfected an organization to harmonize with that of the Bureau. He was succeeded in this assignment by Maj. Fred R. Brown, P. S. (captain of infantry).

Maj. H. A. Ripley, P. S. (captain of infantry), remained at Camp Stotsenburg in charge of instructions, drill and target

practice of Scout troops when temporarily withdrawn from rinderpest work.

Organizations and officers participating in the quarantine work consist of the following:

ROSTER OF TROOPS AND STATIONS IN LUZON.

Maj. W. R. Sample (relieved).

Headquarters Ninth Battalion.—Maj. F. R. Brown (captain of infantry); Lieut. J. F. Usry.

Headquarters Eighth Battalion.—Maj. H. A. Ripley (captain of infantry); Lieut. Oscar A. Manseau.

Seventeenth Company, Philippine Scouts.—San Fernando, La Union, and north: Capt. C. L. Stone, Lieut. Fred Damman, Lieut. P. D. Dulay.

Third Company, Philippine Scouts.—Binangonan and Tanay, Rizal: Capt. F. M. Conklin, Lieut. William Buerkle, Lieut. S. E. Shearer.

Nineteenth Company, Philippine Scouts.—San Fernando, La Union, and south: Capt. Harry F. Wilson, Lieut. B. E. Nickerson, Lieut. F. T. McCabe.

Twentieth Company, Philippine Scouts.—Camp Stotsenburg, Pampanga: Capt. Clay Platt, Lieut. H. J. Castles, Lieut. J. F. Daye.

Twenty-third Company, Philippine Scouts.—Santo Tomas, La Union, and Pangasinan–Union line: Capt. I. F. Costello, Lieut. Clarence S. Gould, Lieut. Max Sebald.

Twenty-fifth Company, Philippine Scouts.—Dagupan, Pangasinan: Lieut. George M. Clevenger, Lieut. John McNeil.

Twenty-sixth Company, Philippine Scouts.—Biñang, Laguna: Capt. H. M. Joss, Lieut. C. N. Cecil, Lieut, Per Ramee.

Twenty-seventh Company, Philippine Scouts.—Camp Gregg, Pangasinan: Capt. Peter Peterson, Lieut. C. F. Codori.

Twenty-eighth Company, Philippine Scouts.—Calamba, Laguna: Capt. A. W. Barry, Lieut. F. H. Mann.

Thirty-second Company, Philippine Scouts.—Camp Stotsenburg, Pampanga (detachments Guagua and Floridablanca): Capt. George M. Wray, Lieut. Hugh Straughn, Lieut. L. S. Williams.

Thirty-fifth Company, Philippine Scouts.—San Pablo, Laguna: Capt. M. E. Morris, Lieut. Edward Parfit, Lieut. W. H. Sullivan.

Thirty-eight Company, Philippine Scouts.—Subic, Zambales: Capt. George F. Abbott, Lieut. Thomas Gordon, Lieut. T. A. Lynch.

Thirty-ninth Company, Philippine Scouts.—Camp Stotsenburg, Pampanga (detachment Arayat): Capt. Emil Speth, Lieut. Joseph W. del Alamo, Lieut. J. M. Harris.

Forty-eighth Company, Philippine Scouts.—San Antonio, Zambales: Capt. Edward Bennett, Lieut. F. L. Hoerner.

Forty-first Company, Philippine Scouts.—Camp Gregg, Pangasinan: Capt. Howard White, Lieut. Harry A. Seymour.

(NOTE.—The above companies comprise, on the average, one hundred enlisted men.)

The following lieutenants in the Medical Reserve Corps, in order of assignment, have performed duties in connection with troops on rinderpest quarantine duty: F. M. Wall, V. E. Watkins,

F. M. Wells, H. F. Philips, L. A. Lavanture, G. W. Cook,[1] A. M. Guittard, H. W. Yemans, W. A. Christensen, L. B. Peck, A. McD. Coffey, F. H. Mills, J. C. Griffin, V. E. Miltenberger.

Rinderpest work was started in the Province of Panay under charge of Maj. Hanson E. Ely, Philippine Scouts, who was succeeded by Maj. Alvord Van P. Anderson, Philippine Scouts, who is now in charge.

Troops operating in Panay.

Organization.	Commissioned personnel.	Enlisted strength.	Remarks.
Headquarters Fifth Battalion Philippine Scouts.	Maj. H. E. Ely, Lieut. R. G. Craven, Lieut. J. W. Strohm.	----------	Relieved by Major Anderson, July 10.
Headquarters Seventh Battalion Philippine Scouts.	Maj. A. V. P. Anderson, Lieut. E. C. Wright, Lieut. J. M. White.	----------	Assumed charge, July 10.
Seventh Company Philippine Scouts.	Capt. R. E. Brooks, Lieut. H. M. Rimmer, Lieut. J. P. Vachom.	105	Lieutenant Rimmer also attached to Tenth Company.
Tenth Company Philippine Scouts.	Lieut. H. M. Rimmer	51	Relieved.
Thirteenth Company Philippine Scouts.	Capt. H. McElderry, Lieut. E. B. Miller, Lieut. W. P. Kelleher.	109	To be sent back to Camp Connell, Samar, about November 15.
Twenty-first Company Philippine Scouts.	Capt. R. Dickson, Lieut. J. S. Young, Lieut. M. F. Cooney.	111	Work in Panay completed.
Twenty-fourth Company Philippine Scouts.	Capt. S. M. Neisser, Lieut. R. G. Craven, Lieut. A. Tucker.	102	
Forty-ninth Company Philippine Scouts.	Capt. C. M. Spears, Lieut. L. B. Bennett.	109	To be returned to Camp Ward Cheney about November 15.
Medical Corps	Lieut. G. P. Stallman, Medical Reserve Corps.	(a)	

[a] Detachment of Hospital Corps.

The Sixth Company, Philippine Scouts, in charge of Lieut. Patrick Moylan and Lieut. John F. Miller, are operating in northern Leyte.

From time to time other officers and detachments from some other organizations have been temporarily on rinderpest duty, but the names and organization from which the detachments were drawn are not available at the moment.

The Philippine Scouts are an indispensable adjunct in the campaign, not only as quarantine guards, but by actual participation in work of inspection in the infected and suspected territory. The following specimens of instructions and forms, selected at random, illustrate the admirable military thoroughness with which the work is done:

NONINFECTED BARRIOS.

The following instructions will be enforced by all members of the Nineteenth Company, Philippine Scouts, on quarantine duty in the barrios NOT INFECTED WITH RINDERPEST, in the municipality of ...., P. I.:

[1] Medical Corps.

1. Allow no carabaos or cattle to leave the municipality, except when a guard is furnished by the company commander (authorized by the veterinarian in charge).

2. All carabaos and cattle must be tied up or placed in corrals on the premises of the owner or caretaker, on the days and dates specified for inspection, and thus held until the inspection is completed.

3. All places where cattle or carabaos are detained, must be kept in a sanitary condition at all times.

4. In the below-named barrios, on the dates specified, the noncommissioned officer in charge of each post will detail men to inspect and list all carabaos and cattle, using the blank form provided for that purpose. Should a sick or suspicious animal be found, it will be isolated immediately, placed under guard, and the matter reported without delay, using the blank form provided for that purpose.

Names of barrios.	Dates of inspection.
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5. Upon completion of all required inspections (if no infection is found) the teniente of each barrio will be notified in writing that the animals have been inspected and are no longer required for inspection, that date.

6. The animals of more than one owner should never be assembled in one place for inspection, as the mixing of animals of various owners is the chief means of spreading infection.

7. When animals are absent from inspection for any reason, the matter must be investigated very closely, and the owners or caretakers required to produce the animals, if possible, as absent animals are the ones that are sick generally. Owners or caretakers must be informed that if animals are absent from inspection a second time, it will be necessary to place the delinquent animals in quarantine for ten days.

8. On days when animals are not required for inspection, they will be allowed to go free within the limits of the municipality (except in barrios quarantined). The necessary patrols must be made to see that there is no violation of this rule.

9. Any irregularities found to exist in regard to quarantine rules must be reported to the veterinarian, the live-stock inspector, or "special inspector" visiting each post daily.

(Signed) H. F. WILSON,
Captain, Philippine Scouts,
Commanding Nineteenth Company.

INFECTED BARRIOS.

The following instructions will be enforced by all members of the Nineteenth Company, Philippine Scouts, on quarantine duty in the municipality of ...., P. I.:

1. All animals (except horses and mules) must be tied up or kept in corrals, until written notice of release is furnished the teniente of each infected barrio, by the representative of the Bureau of Agriculture in charge of the municipality.

2. Two men will inspect daily all carabaos and cattle, and the non-commissioned officer in charge of each post will arrange his detail of men in such a manner so as to have the animals inspected by different men each day.

3. A careful check must be made of the number of animals inspected, and a record of same will be kept on the blank form provided for that purpose.

4. At any time when a sick or suspicious animal is found it must be isolated immediately, placed under guard, and the matter reported without delay, using the blank form provided for that purpose.

5. All places where carabaos or cattle are tied, or where they are kept in corrals, must be kept in a sanitary condition at all times. A separate sink for each animal must be dug about one meter wide and one meter deep, and all refuse matter from each animal deposited therein. When the animals are tied up, they must be kept at least twenty feet apart.

6. Upon completion of inspection of an infected animal, or, upon leaving an isolation corral containing infected animals, the disinfectant furnished by the Bureau of Agriculture will be used as directed by the veterinarian in charge. No person except a representative of the Bureau of Agriculture will be allowed to enter an isolation corral, which must be guarded at all times.

7. Patrolling will be so arranged by the non-commissioned officer in charge of each post, that there will be absolutely no movement either during the day or night of any carabaos or cattle.

8. All quarantine orders must be enforced with firmness, kindness and justice, and, if any irregularities are found to exist in regard to the quarantine, they must be reported without delay to the veterinarian in charge, or live-stock inspector, or "special inspector" visiting each post daily. If the matter be of a serious or important nature, the report should be forwarded by messenger without delay to headquarters.

9. All lawful instructions from representatives of the Bureau of Agriculture concerning the quarantine will be received, transmitted and obeyed by each member of this organization.

10. Each member of this organization will assist by every legitimate means the officials and representatives of the Bureau of Agriculture in carrying out the spirit of the work in connection with the quarantine, with a view to ultimate success.

(Signed) H. F. WILSON,
Captain, Philippine Scouts,
Commanding Nineteenth Company.

Date, ..., 191

The TENIENTE,
Barrio ...., *P. I.*

You are hereby notified that the inspection of carabaos and cattle in your barrio has been completed, and the animals are no longer required to be tied up, or kept in corrals during the balance of this day.

Very respectfully,

.... Co., P. S.
Acting Live-stock Inspector, Bureau of Agriculture.

(Not to be submitted if infection is found.)

Report of animals inspected by detachment .... Co., Philippine Scouts, from Post No. ...., located in the barrio of ...., P. I.

Name of barrio.	Municipality.	Province.	Date.	Total present.	Total absent.
Carabaos .... Cattle					

Inspected by—

..................................., *Co., P. S.*
..................................., *Co., P. S.*

(Enter on back of form, name of owners or caretakers of animals absent.)

Report of animals found sick by detachment .... Co., Philippine Scouts, from Post No. ...., located in the barrio of ...., P. I.

Carabaos.	Cattle.	Male or Female.	Brand.	Owner.	Caretaker.	Barrio.	Date.

Found by— Time { .... a. m. / .... p. m.

....

....

Corporal, ... Co. P. S. in charge of Post No. ....

(As soon as a sick or suspicious animal is found, it must be isolated immediately, placed under guard, and this report forwarded without delay to the veterinarian in charge of the municipality.)

Weekly report .... Date, ..., 191 ....
District, municipality of ...., P. I.

Barrios inspected.	Animals present.	Animals absent.	Remarks.

NOTE.—Enter under "Remarks" brief information of infected or suspicious animals found during the week, and all irregularities found to exist.

....

Sergeant, ... Co., P. S., Special Inspector.

Distribution of detachments and posts of Nineteenth Company, Philippine Scouts, and days of inspection of animals in barrios.

Municipalities.	Number of men.	Number of post.	Names of barrios.	Days of inspection.
Bacolor [a]			Cabalantian	Every Monday.
Do			San Vicente	Do.
Do	8	6	Maliwalo	Every Tuesday.
Guagua [a]			San Matias	Every Monday.
Do			San Roque	Do.
Do			San Juan Bautista	Do.
Santa Rita [a]			Diladila	Every Monday and Thursday.
Do			San Juan	Every Tuesday and Friday.
Do	10	2	San Jose	Every Wednesday and Saturday.

RÉSUMÉ.

No.	Municipalities.	Barrios.	Posts.	Officers.	Enlisted men.	Inspections.
1	Bacolor	15	3	1	33	15
2	Guagua	22	3		25	27
3	Santa Rita	10	5	1	48	30
Total	3	47	11	2	106	72

[a] These municipalities contain many more barrios than shown in this model report, thus totals in résumé do not coincide with the data shown.

(Signed) H. F. WILSON,
Captain, Philippine Scouts,
Commanding Nineteenth Company.

NOTE.—The schedule of inspection is arranged by the veterinarian in charge and is subject to change by his direction.

The rinderpest campaign with Philippine Scouts has involved work in Leyte, Cebu, Oriental Negros (and subprovince of Siquijor), Iloilo, Laguna, Bulacan, Nueva Ecija, and Bataan, all of which are believed now to be free from rinderpest. Work is in progress in Leyte, Capiz, Rizal, Zambales, Pampanga, and La Union.

The Philippine Constabulary is aiding in various minor outbreaks to the fullest extent possible consistent with the size of the force available for this and the other important duties of that organization.

The progress of the work is shown by the table illustrating rinderpest conditions:

(*a*) Batanes bull, third day of temperature—shows drooping of head, lopping ears, congestion of veins of face, and general depressed appearance.

(*b*) Batanes bull in the latter stages of rinderpest—shows general depressed appearance, drooping head, lopping ears, arched back, eyes sensitive to light, staring coat, and emaciation.

PLATE II.

(*a*) Indo-Chinese bull, fourth day of temperature—shows discharge from the eyes and their extreme sensitiveness to light.

(*b*) Batanes bull in latter stages of rinderpest—shows general depressed appearance, lopping ears, drooping head, discharge from eyes, and drooling from mouth.

PLATE III.

(a) Indo-Chinese carabao in the latter stages of rinderpest—shows head held around to side, uneasy position, due to front leg being knuckled under neck.

(b) Formosan cow in the latter stages of rinderpest—shows head held near flank and depressed appearance.

PLATE IV.

TABLE I.—*Rinderpest.*

Fiscal years.	Quarters.	New cases.	Deaths.	Average number— Barrios infected.	Average number— Municipalities infected.
1911–12	First	1,276	937	110.2	43.4
	Second	1,240	827	77.4	35.4
	Third	997	559	69.3	26.9
	Fourth	799	524	60.0	30.8
1912–13	First[a]	606	390	46.6	24.0

[a] Ending September. 30, 1912.

During the week ending November 2, 1912, municipalities in which rinderpest was known to exist were as follows: Isabela, 1; La Union, 5; Pangasinan, 2; Tarlac, 1; Pampanga, 4; Rizal, 1; Zambales, 2; Capiz, 1; Antique, 1; a total of 18. Of these there were cases discovered in only 12 during the week.

While rinderpest is not doing serious damage at the moment its presence is a potential danger of grave magnitude. All efforts are being directed to extinguishing the last embers of infection, lest later a conflagration be kindled from them.

SYMPTOMS AND LESIONS PRESENTED BY CATTLE AND CARABAOS SUFFERING FROM RINDERPEST IN THE PHILIPPINE ISLANDS.

By WILLIAM HUTCHINS BOYNTON, D. V. M., *Pathologist.*

In rinderpest, as is true for most infectious diseases, occasionally animals do not present the symptoms and pathological changes which are supposed to be typical of that disease. In this particular paper the writer intends to describe only those symptoms and pathological changes which are most prevalent in cattle and carabaos suffering from that disease.

SYMPTOMS.

The first symptom of rinderpest is a rise of temperature above normal. This high temperature continues with little variation throughout the course of the disease. In fatal cases the temperature often falls below normal just before death. In those cases which recover, the temperature gradually subsides to normal.

The normal temperature of cattle and carabaos in the Philippine Islands varies somewhat with the season of year. During the hot dry season it is usually from three-tenths to seven-tenths of a degree higher than during the rainy season. The average normal temperature varies from 37.7° C. to 38.4° C. in the morning, and 38.5° C. to 39.5° C. in the afternoon. These temperatures were observed in animals which were at rest and in the shade. However there may be great variations in the temperature of animals which are standing in the sun or that have been deprived of water, or are at work. In such cases the temperature may be a degree or more higher than that when at rest and in the shade.

In rinderpest, during the maximum of the febrile period, the morning temperature of an animal at rest varies between 39° C. and 40° C. The afternoon temperature varies between 40° C. and 41° C. the average being about 40.6° C.

The first rise of temperature varies from the third to the fifth and in some cases the sixth day after the animal has come in contact with sick animals, their excreta, or after artificial inoculation with virulent material. Usually an animal which contracts the disease naturally shows a slightly longer incubation period than an animal which has been inoculated with virulent material.

On the first day of temperature, an animal affected with rinderpest usually has a more lively appearance than normal. The eyes are bright, it is easily excited, and shows many evidences of being under a slight nervous strain. This appearance is more prevalent among cattle than carabaos, and also among the smaller more exitable type of cattle than in the larger breeds.

On the second or third day of temperature the animal usually becomes docile. In many instances the hair does not lie as smoothly over the body and loses the glossy appearance which is present in a healthy animal. The ears lop forward and the conjunctivæ become congested. The eye lesion is especially prominent in carabaos, and in many instances is present on the first day of temperature.

As the disease progresses the animal usually becomes listless. The head droops to the ground, the eyes become sensitive to light, and as a result they are kept closed or partly so, most of the time. As a rule there is a profuse discharge of tears from the inner canthus of the eye. The tears run down the face and keep the hair and skin constantly wet. Frequently in the later stages of the disease there is a sero-purulent discharge from the eyes. However, the eye lesions are quite varied in cattle and in some instances are hard to detect, except the sensitiveness to light which is most constant. Frequently in those cases where there is a profuse discharge of tears, the inner canthus of the eye will be swollen, the area over which the tears run will have a scalded appearance and the hair usually falls out.

The nostrils become congested and in many cases there is a sero-purulent, or a thick viscid discharge from them. The muzzle is usually hot and dry.

The onset of diarrhea varies somewhat in different animals. The average is in the neighborhood of the third or fourth day after the rise in temperature. As a rule diarrhea makes its appearance a little earlier in carabaos than in cattle. Diarrhea is sometimes preceded by slight constipation, but this feature is not constant. Usually with the onset of diarrhea an animal loses appetite, which condition rapidly increases. In a day or

so it will refuse food, rumination ceases, and there is marked thirst. At this period of the disease the animal usually stands with the back arched, the hair does not lie smoothly over the body, the head is held near the ground, the ears lop forward, and the eyes are closed or partly so. If the animal is watched closely, frequent tremors may be seen to run through the body, as if the animal were suffering from a chill.

There is usually a slight, and, in some cases, a profuse drooling from the mouth, and, in many instances, the animal will be heard grinding the teeth. Although this is not a constant symptom, it is quite prevalent especially in the latter stages of the disease. The animal, as a rule, looses flesh rapidly from the onset of diarrhea to either death or recovery. In the latter stages the feces become very liquid and have an offensive odor. In some cases blood and mucous casts are present but these elements are not constantly present.

As a rule the animal strains a great deal while defecating and in some cases groans as if in great pain while in the act. In cases where the animal becomes very weak and is not able to arch the back, the anal sphincter muscle looses its tension and apparently becomes paralyzed. The animal holds its breath and by tucking up the abdomen is able to force the fecal matter out. This act is accompanied by grunting, groaning, and sucking in and expelling air from the anus. The watery fecal matter runs down the thighs and soils the hair on the legs and tail. Frequently in the latter stages of fatal cases the animal will be seen defecating involuntarily. These appearances usually occur just prior to death.

About the time diarrhea sets in, or a day or so after, erosion ulcers are frequently found in the mouth. The animal's breath is usually foul-smelling. The erosions are usually located on the inner surface of both upper and lower lips, at the commissure of the lips and on the conical papillae. The erosions may be diffuse giving the inner surface of the lips a scalded appearance or there may be isolated areas either circular, oblong or with jagged uneven borders. These are covered with a yellowish gray exudate which is easily removed, leaving a raw surface underneath. The conical papillae in many cases are partly or completely eroded off. Now and then, erosions on the dental pads have been noticed, and they are also frequently present on the hard palate. As a rule these erosions are not deep but merely extend through the epithelial layer; in some instances, especially where secondary infection has taken place, they are deep-seated.

In some cases, especially in carabao, about the time diarrhea starts, an exudate may be present in the pocket-like cavity located between the root of the tail and the anal opening. This exudate is usually of a dirty yellowish color, moist and cheese-like. It is quite easily removed, leaving a raw surface underneath having the appearance of being covered with pustules. This appearance is not constant, but when present may be considered as a positive lesion of rinderpest.

In the latter stages of the disease the animal as a rule lies down the greater part of the time. It usually rests on the left side, apparently to have as little pressure as possible brought upon the fourth stomach, duodenum, caecum, and colon. In many instances colicky symptoms are shown by the fact that the animal will persistently keep the head against the side, show all the symptoms of pain and groan frequently.

In some instances the animal will remain standing to within a few minutes of death, when it drops, struggles violently for a short time, often uttering low muffled bellows. When at the point of death, the head is thrown back, the body becomes rigid, and the eyes open with a wild stare. Frequently there is wrinkling of the face with opening and closing of the mouth. In other cases the animal may lie in a sprawled-out position for a period varying from several hours to a day before death and hardly move.

Usually in fatal cases, the animal becomes extremely weak in the hind quarters, and has a wabbly gait when it attempts to move. On the other hand some animals appear strong up to within a short time of death.

Some cases, especially among the small nervous breeds of cattle during the latter stages of the disease, show twitching of the limbs which may appear in either the front or hind quarters. The writer has noticed this symptom so marked in a bull that the animal was unable to keep the affected limb on the ground.

In the latter stages of the disease erosions, covered with a yellowish-gray exudate, may be found on the lips of the vulva, but this lesion is not constant. One of the apparently constant lesions in the male is congestion of the penis. In some instances erosions may be present, and there is usually a slight thick, yellowish, purulent discharge from the sheath. Often this discharge is cheese-like and similar to the exudate which covers erosions in other parts of the body.

The duration of the disease in fatal cases varies from three to ten days after the initial rise in temperature. The average

is in the neighborhood of six days. In some instances an animal may regain its normal temperature and begin to eat, but is not able to regain its strength. Such cases usually die in three or four weeks.

The body of a carabao after recovery from rinderpest frequently becomes covered with an eruption having the appearance of pustules. This lesion is especially prominent on the neck and belly. Possibly this eruption may be caused by the fever through which the animal has passed. This appearance, however, is not constant and the writer has never noticed it in cattle.

MORBID ANATOMY.

When performing an autopsy upon an animal which is supposed to have died of rinderpest, too great precaution can not be taken in examining every part of the carcass. Every lesion found adds to the strength of verifying the case in question.

As stated before, this paper only deals with the ordinary case of rinderpest. The marked variations which sometimes occur are not considered here.

For convenience of description we will start at the head and describe the conditions found through the body in the order of the location of the organs.

The first things to look for are: Marks of a discharge from the eyes, swelling of the inner canthus, has hair fallen out around this area or in the track where the tears have run down the face. One should also notice if the hind legs and tail are soiled from fecal matter. The nostrils should be examined for any discharge, or congested appearance of the mucous membrane, and the mouth should be examined for the erosions which have been mentioned.

Upon opening the head, the lining of the superior turbinal cavity is frequently found congested. The area of the inferior turbinal cavity is almost constantly congested, and at times to such an extent that it takes on a purplish red color. This cavity may also be partially occluded by the marked congestion present.

In many cases the septum nasi is markedly congested, and swollen to such an extent as to partially or practically occlude the cavity. This undoubtedly is one of the causes for the difficulty which some animals experience in breathing through the nose during the latter stages of the disease.

The brain and spinal cord have been found markedly congested

in every case in which the writer has looked for this particular condition.

Erosions covered with grayish-white exudate are constantly found on the palate, walls of the pharynx and at the base of the tongue. Congestion of the epiglottis and arytenoids is very constant. Congestion and in some cases hemorrhages in the upper portion of the trachea are quite constant. Congestion, and in the majority of cases, erosions covered with a yellowish-gray exudate are present in the upper portion of the aesophagus.

The lungs, as a rule, show no very marked changes. Occasionally emphysema is prominent, but this appearance is not constant. Sometimes congestion is present, but one has to be careful and not mistake hypostatic congestion for a lesion of rinderpest.

In a certain percentage of cases hemorrhages are found either on the external surface or on the inner walls of the heart. The appearance of these lesions varies considerably in different outbreaks and different strains of virus. In some instances heart lesions will be present in a high percentage of cases, while in others they are seldom found. In practically every case the heart muscle is rather pale in color. When lesions are present, they appear as small hemorrhages usually located along the coronary or the longitudinal grooves. When hemorrhages are present on the inner walls of the heart they appear in the left ventricle. In but one instance has the writer noticed hemorrhages in the right ventricle and in this case there were also extensive hemorrhages in the left ventricle.

The gall bladder is, as a rule, considerably distended with bile. The bile may vary from a dark green to a light-yellow color. It may be watery or very thick in consistency. In those cases where the bile is thickened, the bile capillaries in the liver are markedly congested, and the liver as a rule is bile-stained. The gall bladder is usually congested. In some cases the congestion is slight while in others it is very marked. A few cases have been noticed where ulcers were present.

The liver is ussually congested, shows the appearance of cloudy swelling and in some instances is bile-stained.

The kidneys as a rule are slightly congested and may show a blotchy appearance over the cortical surface.

The pancreas and spleen, in the writer's experience, have a normal appearance.

The lymphatic glands, as a rule, are affected. Those located in the mesentery show the most prominent changes. The glands

are enlarged, frequently congested, and, in some instances, oedematous.

The urinary bladder is quite constantly congested, sometimes shows hemorrhagic areas, and the walls may be thickened. There is usually a marked congestion of the upper portion of the urethra as it leaves the bladder.

In the first, second and third stomachs there are no noticeable lesions except in extraordinary cases where the epithelial layer of the first stomach is rather easily removed. In some instances ulcers have been found in the third stomach around the valve which separates it from the fourth stomach. This appearance has been noticed only in those cases where there was marked ulceration of the fourth stomach. By all appearances the ulceration extended through the valve from the fourth stomach into the third. The contents of the third stomach are usually very dry.

The fourth stomach as a rule is the organ in which some of the most marked pathological changes occur. Its appearance varies considerably in different cases. Usually the contents are liquid, of a very foul odor, and often contain a considerable amount of mucus. The mucous membrane may be found in various grades of inflammation, from a slight pinkish to a deep purple color. The areas of inflammation also vary. In some cases it is localized in the lower portion of the stomach, in others near the pyloric portion, and in others it is diffuse throughout. Erosion ulcers are quite constant and may be distributed in a similar manner as described for the inflammation. They are more plentiful when there is a marked congestion present. The erosions are usually covered with a grayish exudate. In many instances the exudate is detached leaving a purplish-red raw surface exposed. In the lower portion of the stomach the erosions usually occur on the edges of the folds, although they may be located at the base of, or between the folds. Frequently small hemorrhagic points are found along the sides and at the base of the folds. Deep seated ulcers are occasionally found at the pyloric end of the stomach. These are usually infected with secondary invaders. The walls of the stomach, especially in the vicinity of the pyloric opening, are in some instances thickened and oedematous.

Congestion of the duodenum is quite constant. It may appear diffusely throughout or in blotches. As in the fourth stomach various grades of inflammation may be present. In some instances erosion ulcers are present, and take on the same appear-

ance as those described above. Frequently the walls of the duodenum are swollen and oedematous.

The bile duct is usually congested and swollen, and, in some instances, oedematous, which may be one reason for the damming back of the bile in the gall bladder.

In some instances the jejunum and ileum are markedly congested, but the average case shows very little change except for a slight congestion.

The caecum usually shows a marked congested and hemorrhagic appearance of the mucous membrane. This appearance may be diffuse throughout the organ, or only in part.

Usually the changes are most prominent in the vicinity of the ileo-caecal valve. The congestion and hemorrhages may occur in streaks running lengthwise the organ, or they may appear as blotches. Erosions are sometimes found in this part, but are not constant. The ileo-caecal valve is frequently partly eroded, swollen, or oedematous. Peyers' patches are usually swollen and congested. In some instances the caecum is practically denuded of its epithelium, and in this case the walls appear very thin and flabby. In other instances the walls may be thickened and oedematous.

The colon is frequently congested to a more or less extent throughout its length. The congested and hemorrhagic areas may occur in either streaks or blotches. Very small erosions are frequently noticed, but one has to be very careful or they will be overlooked. In some instances the wall of the colon is thickened and oedematous.

The rectum is one of the portions of the internal tract which shows lesions very constantly. It is usually markedly congested and in many instances shows a multitude of small hemorrhagic points. The congestion and hemorrhages usually run in streaks, although it may be diffuse. Erosions are very rare in this area. One has to be careful and not confuse injuries caused by the thermometer while taking the temperature with the ulcers caused by rinderpest. Frequently the walls of the rectum are swollen and oedematous. In some instances it is practically denuded of epithelium, especially in the region adjoining the anal opening. In these cases the walls are thin and flabby, this condition being especially prominent in animals that have a relaxed anus before death.

Frequently the epithelium of the anal opening is cracked, giving it a chapped appearance. In many instances a dirty yellowish gray exudate is present around the orifice.

Erosions covered with a grayish-yellow exudate are frequently found on the lips of the vulva. Congestion is usually present around the urethral opening. The cervix is quite constantly congested.

In the male the penis is almost constantly congested. Frequently small erosions are present. The sheath is almost invariably congested, and, in some instances, to a very marked extent, often taking on a purplish red color. There is usually a thick yellowish cheesy exudate present on the glands.

Peritonitis is constantly present. The peritoneum is often coated over with a fibrinous exudate. This is especially prevalent over the region of the small intestines and fourth stomach.

SUMMARY.

1. The most constant clinical symptoms of rinderpest are: (*a*) rise in temperature above normal, the temperature remaining high throughout the course of the disease, or until just prior to death when it frequently drops to sub-normal; (*b*) a dejected appearance of the animal, lopping of ears, head lowered, eyes sensitive to light. In carabaos there is congestion of the eyes; (*c*) diarrhea, loss of appetite, thirst, emaciation, prostration, congestion and discharge from all mucous membranes.

2. The most constant morbid appearances, in order of frequency with which I have observed them, are: (*a*) peritonitis; (*b*) congestion and ulceration of the fourth stomach; (*c*) congestion of the duodenum, caecum, colon, and rectum; (*d*) congestion of the vagina, glands, penis, and sheath; (*e*) erosions in, and congestion of, the larynx; (*f*) congestion of the brain and spinal cord; (*g*) enlargement of the lymphatics especially those located in the mesentery.

From the veterinary research laboratory, Bureau of Agriculture, Alabang, Rizal, P. I.

THE NORTH TO SOUTH MOVEMENT OF ANIMALS ON THE ISLAND OF LUZON.

By Dr. STANTON YOUNGBERG, *Supervising Veterinarian.*

The Philippine Islands are an unfenced country. Thus the difficulty of regulating the movement of animals renders the control and final eradication of rinderpest from these Islands a very complex problem. What is true of the country as a whole applies especially to the Island of Luzon, with its extensive and fertile central valley in which there is a constant movement of animals in all directions with an added continual influx from the north.

The Island of Luzon is divided geographically into three parts, viz, northern, central, and southern. For the purposes of this article it is not necessary to consider the southern portion, which obtains its supply of carabao mostly from those imported into Manila or from adjacent southern islands.

Northern Luzon is cut up by three mountain ranges, running from north to south and practically paralleling each other. The Sierra Madre runs down the east coast. The Caraballos runs down a little to the west of the centre to a little above the sixteenth parallel where it merges into the Caraballos Sur which runs southeast and finally joins the Sierra Madre. Between the Sierra Madre and Caraballos lies the fertile Cagayan Valley. The Sierra de Ilocos runs along the western coast, is not as high as the other two ranges, and does not form a connected chain. The Ilocos Provinces occupy a long narrow strip between these mountains and the sea.

Central Luzon extends from Lingayen Gulf south to the Tagaytay Mountains, which are a short distance below Manila. On the west are the Zambales Mountains and on the eastern coast a continuation of the Sierra Madre. Between these two ranges lies the extensive central valley which covers more than 3,000 square miles and embraces the following provinces: the greater part of Pangasinan, Tarlac, Nueva Ecija, Pampanga, and Bulacan.

In this central valley there is a shortage of carabaos, the animals most commonly used for work purposes in this section. Two reasons can be assigned for this shortage. The completion of the lines of railway through this valley opened up large tracts of unoccupied land in Pampanga, Tarlac, and Nueva Ecija, a great deal of which is suitable for the cultivation of sugar. Thousands of acres have been and are being settled by Ilocanos from the crowded narrow strip of seacoast comprising the Provinces of Union, Ilocos Sur, and Ilocos Norte, many of whom bring their own animals. Since 1887 rinderpest has caused great losses among the carabaos and cattle of this section, carrying off every year a large number of the younger susceptible animals. This, combined with deaths from ordinary causes, and neglect of proper breeding, results in a shortage of animals even in the older well-settled districts.

The hill country of Pangasinan, which, on account of its rough mountainous character, is essentially pastoral instead of agricultural, and the Ilocos Provinces, have not been affected by rinderpest as severely as the central valley. The reason for this is that, on account of the rough nature of the country, the very poor roads, and the proximity to the sea, the majority of the products are transported by water. Therefore, no such continual intermingling of animals occurs as in the central valley. Nearly all of the arable land in these two sections is under cultivation and here more attention is paid to the breeding of animals; thus there is a surplus with which to supply the provinces farther south. The purchase price of a work carabao in these parts is from ₱90 to ₱130. In Tarlac and Nueva Ecija the selling price is from ₱110 to ₱160. Pampanga, the principal sugar province of Luzon, has the largest demand and pays the best prices; good strong males often bring ₱180. When carabao dealers come down from western Pangasinan or the Ilocos Provinces, they may dispose of a few head in Tarlac or Nueva Ecija, but the ultimate destination of the majority is Pampanga. But few of these animals reach Bulacan, as this province buys mostly from Manila.

In the early part of 1911, rinderpest became generalized throughout Pangasinan, the most important rice-producing province in the Islands. A large force of employees of the Bureau of Agriculture, assisted by the Philippine Scouts, was thrown into this province to undertake a thorough clean-up campaign. During 1910 and 1911 outbreaks of rinderpest occurred in seven municipalities of La Union. Although this disease has not been

reported from Ilocos Sur or Ilocos Norte, these provinces have not been declared clean, as the Bureau of Agriculture has not been able to dispose of sufficient additional forces to thoroughly search out this territory. Isolated outbreaks are and have been known in the Cagayan Valley for the past four years; this section is still under the necessity of importing large numbers of animals from the Ilocos country. After the completion of the Pangasinan campaign, the forces were moved southward through the central valley. Consequently, there arose the necessity of protecting this clean territory from the infected and doubtful territory to the north.

As the tide of animal traffic from the north naturally passes through Pangasinan, it was, therefore, necessary to have an adequate check on all animals coming into this province both by land and water.

The Collector of Customs had previously issued Customs Administrative Circular No. 622, regulating the transportation of live stock by vessels engaged in the coastwise trade, extracts of which are as follows:

PAR. II. No live stock shall be carried in the coastwise trade by vessels under fifteen tons gross burden, except hogs, sheep, goats, and other similar live animals.

PAR. III. Before any live stock is received for shipment by a vessel regularly licensed for the coastwise trade, or by a vessel operating without a license, the master, mate, or patron in command of such vessel shall require the person offering said live stock for shipment to present to him a certificate signed by the president, secretary, or teniente of barrio of the municipality from which shipment is made. Such certificate shall contain a description of each animal to be shipped, shall specify the kind of animals, brands, if any, point of origin and point of destination, and shall show that such animals are, to the best knowledge and belief of the officer signing the certificate, free from infectious or dangerous communicable animal diseases.

PAR. V. Upon receipt of a consignment of animals for shipment, accompanied by the above specified certificate, the master of the carrying vessel shall carry them to the port of destination specified in the certificate. Upon arrival at the port of destination, the master of the carrying vessel shall deliver, or cause to be delivered, the certificate to the municipal president and shall refuse to permit the discharge of said cattle at any other port unless said certificate is returned to him indorsed by one of the municipal officers specified in Paragraph III of this circular, of the port named therein, authorizing delivery at some other point. Upon discharging said cattle from the carrying vessel, the municipal president shall take up said certificate, indorse thereon point of delivery and date of discharge, and forward same to the nearest Collector of Customs, who, in turn, will forward it direct to the Director of Agriculture.

The provincial board of Pangasinan adopted resolution No. 495 requiring all large bovine animals brought into the province to be placed in quarantine for a period of ten days under the direction of the local Bureau of Agriculture veterinarian.

The aid of the municipal authorities was also enlisted, and they, through their municipal and barrio police, were constantly on guard for shipments of animals. To patrol the coast, inspect all shipments of animals, and assist in the proper enforcement of the above-mentioned regulations, a launch was placed on Lingayen Gulf in charge of a representative of the Bureau of Agriculture, with headquarters at Dagupan, Pangasinan. Since the inauguration of this system all shipments of animals by water destined for Pangasinan have been registered and placed in quarantine.

The roads from the Mountain Province to the lowlands were easily blocked. A trail runs from Naguilian, Union Province, over the mountains to Baguio, Benguet, and there connects with the road leading to Camp One and on into Pangasinan. The subprovince of Benguet established a quarantine on the Naguilian trail at the Ribsuan River, requiring the certificate of a veterinarian of the Bureau of Agriculture before animals would be allowed to pass. A guard was also placed on the Benguet Road at Camp One and an accurate check kept of all animals going up or coming down the road. Nueva Vizcaya has a quarantine guard on each of the three trails coming into this province, one from Isabela, one from Pangasinan, and one from Nueva Ecija. The foregoing are the only outlets through the mountains that could be used in bringing animals from the north, and they are easily guarded.

The portion of country that presented the greatest difficulties in enforcing an effective quarantine against the north was the broken and hilly strip, 12 kilometers in width, along the Pangasinan-Union boundary, between Rabon on the Lingayen Gulf and Camp One on the Benguet Road. This strip is sparsely settled and broken, by numerous hills which, however, are not rugged enough to prevent the passage of animals. The topography of this section therefore precluded the possibility of maintaining an effective quarantine with guards alone. It was accordingly decided to erect a fence along this line following the Pangasinan-Union boundary as closely as natural conditions would permit.

No scheme of fencing had heretofore been tried in the Islands, hence this was essentially in the nature of an experiment. In

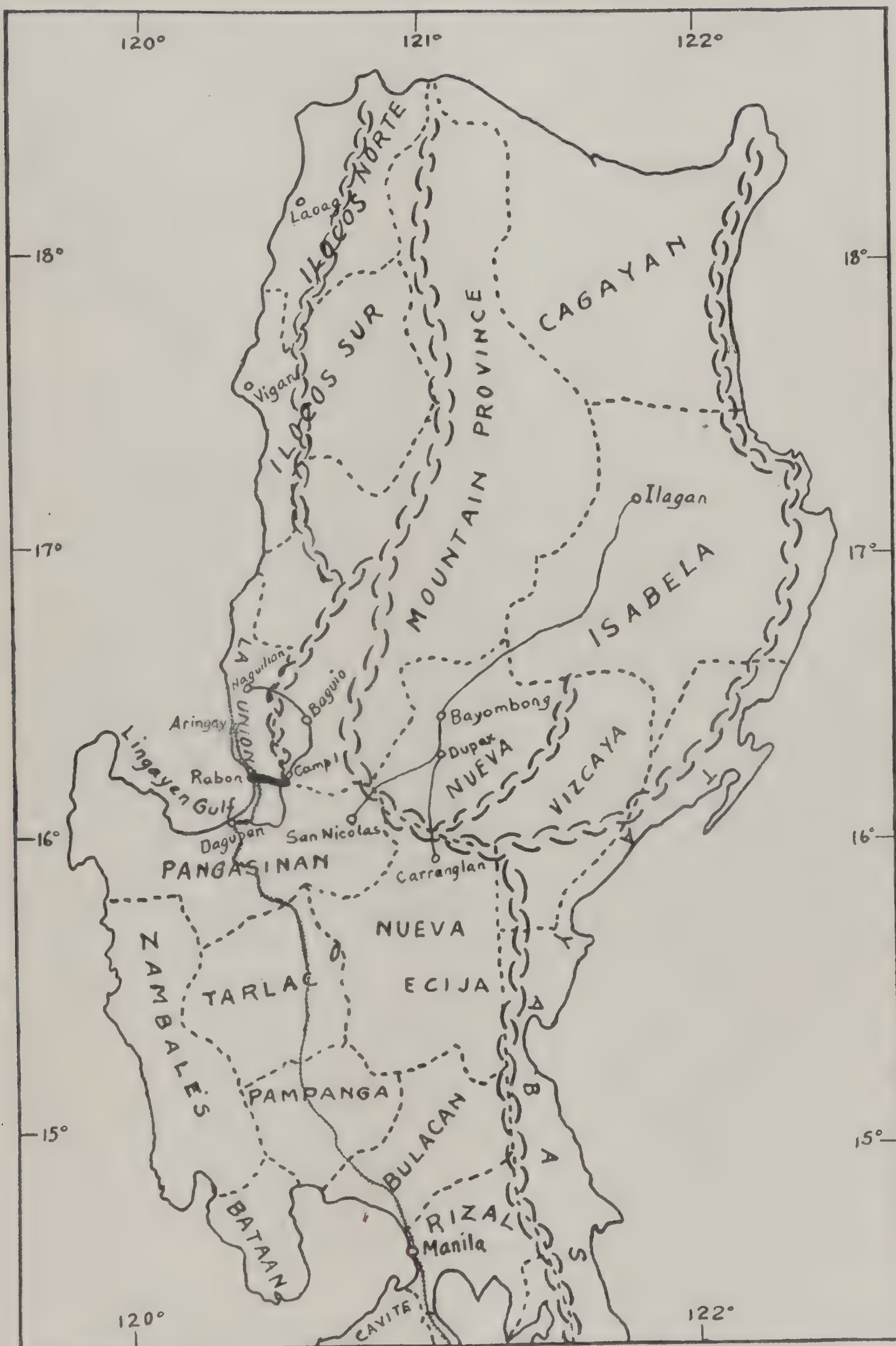

FIG. 1.—Map of Northern Luzon, showing Pangasinan-Union Fence.

view of this fact the construction of a barbed-wire fence was decided upon, which, though less of a barrier than woven wire, was cheaper, and the materials for its construction were on hand in the Islands while woven wire was not immediately available. The type of fence constructed was five-strand, of No. 12 barbed wire, posts 5 meters apart, top wire 1.6 meters high. The posts were cut on the ground, and were mostly of second group timber. On account of the number of destructive insects, and also to prevent rotting, the lower ends of the posts were covered with tar to a height of 2 feet (6.09 decimeters) above ground. Later, owing to the very considerable damage by insects, it was found necessary to tar the entire post.

The fence was erected by the Bureau of Public Works at a cost of ₱3,525.60. This included the clearing of the line, procuring and setting of 2,400 posts, constructing eight Oregon pine gates, and the transportation and stretching of 6,000 kilos of No. 12 barbed wire. Work was commenced the middle of April 1912, and the fence was turned over as complete on June 6. Owing to the fact that for the greater part of the distance the line ran through a very rough, uncultivated country covered with thick underbrush, the clearing of the right of way and the settting of the posts consumed the greater portion of the time. Outside of the two main gates, at Rabon and Camp One, respectively, six others were put in so as to interfere as little as possible with the free movement of animals owned along the line. A complete census was made of these animals, a copy of which was furnished the guards, who have authority to issue passes whenever local conditions so require. By this system no unnecessary hardships have been inflicted on the people living along the line.

The guarding and maintenance of the fence is supervised by two American inspectors—one stationed at Rabon and the other at Camp One, and each responsible for six kilometers—assisted by fourteen Filipino inspectors, who live along the line. These men work in twelve hour shifts; two have to be kept continually on duty along the beach at Rabon, which gives each of the other twelve, there being six on a shift, 2 kilometers of fence to patrol.

The annual cost of the guards is as follows:

2 Americans, at ₱1,800	₱3,600
14 Filipinos, at ₱360	5,040
Total	8,640

It was found necessary to cut a trail and erect several bamboo bridges along the line, otherwise the patrol would have been next to impossible during the rainy season. This work was performed by local laborers paid at the rate of ₱0.50 per day, the total cost being approximately ₱200. The guards attend to the ordinary maintenance, and it is necessary to hire outside labor only to repair the damages caused by heavy rains and floods. The cost of the first year's guard and maintenance will be approximately ₱9,000.

The fence was broken through three times during the first three weeks after its completion, which was, of course, during the time that the guard was being formed and drilled into shape. They were of necessity men new to that kind of work, and were also unfamiliar with the lay of the land, and unacquainted with the people along the line. Dozens of men had to be tried out as several proved to be incapable and others would quit after working a few days. During this formative period eight soldiers were obtained from the Constabulary of Union Province to assist in guarding the line. As no further attempt was made to break through the fence, after seven weeks these soldiers were relieved from duty. The guards now form a selected and well-trained force which has become thoroughly familiar with, and enjoys, the work. All animals passing through overland to the central valley are required to be sent by rail. A quarantine station is maintained at Aringay, Union, at the end of the railway, where the animals are subjected to a ten days' quarantine and are then shipped to their destination. No animals are now coming into the central valley from the Ilocos country, either by land or water, which have not undergone a ten days' quarantine period and have the proper certificates issued by a representative of the Bureau of Agriculture.

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CATTLE IMPORTATION.

By Dr. George S. Baker.

There were imported into the Philippines 19,061 cattle and 10,356 carabaos from July 1, 1911, to June 30, 1912. These figures include all classes of the above animals, that is, work, beef, breeding, and dairy stock. These animals came into the Philippine Islands through the ports of Manila, Iloilo, and Cebu. The Manila importations include those landing at Sisiman, Bataan Province, as well as at Manila proper, the latter being the "port of entry" for the former. They came from the following countries: Cambodia, Australia, New Caledonia, Formosa, and the Island of Timor.

At the present time, August, 1912, Manila is the only port through which cattle and carabaos are permitted to enter the Philippines, it being the only port provided with anything like adequate quarantine facilities. It became necessary to close the ports of Iloilo and Cebu because the Government had not the equipment at either port to properly safeguard the live-stock interests of the Islands.

While restricting the landing of foreign animals to Manila adds slightly to the cost of those intended for the Visayas, this increase is more than compensated for by the lessened danger to the provincial live stock. However, there is a prospect that the situation may be remedied by the construction of a suitable quarantine station at Iloilo.

During the fiscal year ending June 30, 1912, there were landed at Manila from foreign ports, 14,066 head of live stock. Of these 11,309 were cattle and 1,906 carabaos.

Manila is provided with a fairly good quarantine station located at Pandacan and fronting on the Pasig River. Cattle and carabaos are transferred from ships in the bay to lighters and landed directly in the station. The quarantine grounds consist of about six hectares. There are fourteen concrete, tile-roofed sheds, provided with concrete mangers and water

troughs, each capable of accommodating about one hundred head of cattle. These sheds are arranged in blocks of three and are all surrounded with a five-foot wire fence with locked gates between the different blocks and in the alleyways. This permits of the separation of different shipments of live stock, and, in case disease appears, the Bureau is able to confine it to the lot affected. Six thousand five hundred and thirty-three cattle and 2,527 carabaos passed through the Pandacan quarantine station during the past fiscal year. An entrance fee of ₱0.50 per head is assessed against all animals entering the station; a charge of ₱0.10 per head, per day, is made for yardage and care; under this arrangement the station is nearly self-supporting. The owner of quarantined stock has the privilege of providing feed for his own animals and the Bureau of Agriculture prefers that he shall do this. The law, however, provides that, if the owner shall fail to feed his animals, the Director of Agriculture shall feed them and collect the cost from the owner. It has only been necessary for the Director of Agriculture to do this once or twice during the past year, the owners preferring to provide for their own stock, as a rule.

The Bureau of Agriculture maintains quite an extensive plant at Sisiman, across the bay from Manila, on the Mariveles military reservation. This plant consists of a number of corrals and a matadero, the whole having been erected at a cost of approximately ₱60,000. Only cattle from Australia are allowed to land at Sisiman, and they only for slaughter in quarantine. Practically all of the fresh unfrozen beef consumed in Manila is supplied from Sisiman. During the past fiscal year 8,104 cattle were landed and slaughtered at this point.

Now, as during the past two years, the general orders regulating cattle importation from the coast of China, require quarantine of imported animals for three months before landing in Manila. However, importers are offered the alternative of having their animals immunized in Hongkong, at their expense, by a representative of this Bureau, subject to the permission of the Government of Hongkong.

During the year past the existence of disease among cattle and carabaos in shipments from Pnum Penh, Cambodia, has necessitated the enforcement of a three months' quarantine on animals from there. Experiments with the immunization of stock from that country by simultaneous inoculation have been highly successful. Arrangements are in progress to permit the importation of cattle and carabaos from Pnum Penh, after immunization before shipment, at the importer's expense.

THE VETERINARY RESEARCH LABORATORY AT ALABANG.

By Archibald R. Ward, *Chief Veterinarian.*

First in importance in combating animal diseases, in a tropical country more particularly, is a research laboratory for the purposes of studying the diseases of live stock with a view to determining their peculiarities as a guide to the employment of measures used in combating them. In recognition of the necessity of research in connection with the field work of the veterinary division there has been a laboratory established with a staff of experts whose scientific training has fitted them for the study of the problems associated with rinderpest and surra. There are employed two veterinarians on pathological work, an entomologist and a foreman, together with the requisite staff of laborers. In order that the work of the laboratory may be closely coördinated with the field work and best serve its needs the whole is under the supervision of the chief veterinarian.

The laboratory is located at Alabang, Rizal Province, at a slight elevation and overlooks Laguna de Bay. It may be reached from Manila by rail or automobile in forty-five minutes. The main laboratory building is a modern reinforced-concrete structure, 12 by 20 meters, accommodating the laboratories of the pathologist and the veterinary entomologist, together with other features of necessity closely associated with them, like stockroom, refrigeration, records, library, dark room, centrifugal machinery, sterilizers, autoclaves, etc. The building is supplied with gasoline and acetylene gas plants.

The pathologist is provided with a private laboratory and a larger general room well supplied with laboratory furniture. Separate chambers are provided for incubator room, paraffin baths and culture room. Among the more important pieces of apparatus available are: microtomes, designed for the paraffin

method, celloidin method and freezing method; paraffin baths, incubator, centrifuge, pressure filtration apparatus, agitating machine, sensitive balances, spectroscope, hemoglobinometer and haematocrit.

The pathological laboratory is equipped with a Zeiss microscope together with accessories such as the usual varieties of oculars and objectives, camera lucida, drawing board, dark field illuminating condenser, blood counting apparatus, etc.

The veterinary entomologist is similarly provided with private office and general laboratory. An ordinary Zeiss microscope and Zeiss dissecting microscope with the usual accessories are available for use. The laboratory is equipped with the ordinary apparatus for an entomological laboratory, such as insect boxes for storage of specimens, dark closets for ecological studies, and breeding cabinets for insect culture.

The laboratory is supplied with a dark room together with photographic equipment such as Zeiss photographic microscope with stand and necessary lenses, microphotographic camera and a 5 by 7 Graflex camera for general work in live-stock studies. The library contains standard reference works on pathology and allied subjects in English and German, but emphasis is being laid on the formation of a library of periodicals for current consultation. There are received at the library about fifty periodicals in English, French, German, and Dutch covering the general field of veterinary medicine, pathology and entomology as relating to disease. It is felt that it is highly essential to have these periodicals instantly accessible to research workers in order to keep them abreast with current progress.

The equipment for the accommodation of experimental animals is most liberal. The plant was formerly used for the production of antirinderpest serum on a large scale with shed accommodation for nearly five hundred animals. When serum production was discontinued there was made available for present purposes an abundance of well-built cattle sheds with galvanized-iron roofs, cement floors, and convenient water supply.

For experiments with surra there is provided a rectangular inclosure simulating natural conditions as nearly as practicable. No roof is provided, the top of the cage being merely closed with screening. Canvas is stretched overhead in case of necessity to protect the animals within from the sun. A section is provided for the growth of plants and trees to provide the shade requirement of insects within the inclosure and a concrete water pool was built likewise for insects.

The shed is covered with brass screen eighteen meshes per inch. It contains three divisions, each with a capacity of two animals. The two end divisions are partitioned into stalls with coarse iron screen with a one-half inch mesh. The central portion is adapted to use as a detention and quarantine section to serve for either wing as occasion demands. The spacious vacant area in the center of the inclosure, entrance to which is made through a double-doored, screened vestibule, serves as a trap room for undesirable flies.

The animals in the three stalls are watered from individual troughs filled by artesian well water.

This rectangular inclosure is 18.6 meters long by 7.3 meters wide. The height is graduated from 2.4 to 3.8 meters. Each end division is 7.3 by 6.3 meters, the middle section 4.2 by 7.3 while the vestibule is 4.3 by 4.4.

It will be noted that this structure is an exceptionally large screened cage and furnishes unusual facilities for the study of insects in their relation to the transmission of disease from one animal to another. Its construction was necessitated by the fact that ordinary screened compartments under a roof are so dark that insects do not behave in a normal manner.

The veterinary entomologist is further provided with a building completely screened throughout and built with a concrete floor and galvanized-iron roof. Eight box stalls are arranged on either side of a spacious runway and have a capacity of from eight to sixteen animals. Each stall is entered through an individual vestibule also fly-screened, opening into the hallway which is screened to the roof. Facilities are provided to render contamination as negligible a quantity as possible. The attendant does not need to enter the stall to feed or water the animals as this is accomplished from the hallway by feeding through a trap door and watering is done by opening a valve on the outside, each stall being provided with a short water pipe connecting with a main pipe on the outside of the stall. The manure is removed through a small door at the bottom of the wall behind the animal.

The length of the shed is 18.6 meters, width 10.2 meters, height at either end 1.8 meters, at center 2.9 meters. The stalls are 3.9 meters in length and 3.1 in width.

There is a low coarse-screened shed for small animals with concrete floor and iron roof. This shed is 8.1 meters long, 7.1 meters wide and 2.4 meters high. In this shed there are double-

decked tables and shelves holding the animal cages, to wit—fifteen monkey cages and thirty-five cages for guinea pigs. These cages are double-screened, fly proof, with iron base holding a closely fitting removable tray. The cage is cleaned by removing the tray. A small aperture at the top of the cage with a screened cover serves as the entrance.

The quarters for the housing of animals in experimental work in connection with the study of such diseases as rinderpest are provided by an E-shaped group of sheds formerly fitted to hold two hundred animals. One wing is provided with a screened operating room with facilities for restraining animals such as stock and operating table. Six screened box stalls, with vestibules, are provided. Such accessories as abundant and convenient water supply, storage rooms for fodder, platform scales, etc., are installed. Another shed completely isolated from the main group will accommodate at one time fifty head of susceptible cattle intended for use in experimental work. In this shed likewise are kept three hundred guinea pigs and seventy-five rabbits to provide material for experimental work.

Since small animals, ordinarily used in experimental work, are not susceptible to rinderpest, an extraordinary number of cattle and carabaos are of necessity used in experimenting with this disease. For instance, during the period from November 1, 1911, to June 1, 1912, there were employed in the laboratory one hundred and thirty-six head of cattle, seventy-six carabaos, twenty-nine horses, eleven goats, four sheep, and three deer. A certain proportion of these cattle and carabaos recovered from the rinderpest and were available for sale.

The pathologist is primarily occupied with a study of the gross and minute pathological changes occurring in rinderpest. Associated with this are experiments designed to reveal the causative agent of the disease.

The entomologial work of the laboratory is devoted to the study of ecological factors in connection with epidemiology of stock disease. All insects employed in experiments tending to demonstrate disease transmission are bred from egg to adult under the personal supervision of the entomologist.

Another important phase is the investigation of the most efficient insecticides in the eradication of insect pests which serve as possible carriers of disease, or are a source of annoyance, endangering the health of work animals. These investigations are conducted both extensively in the laboratory and under field conditions in nature.

Bulletins of the Bureau of Agriculture from the veterinary research laboratory:

No. 19, Experiments on the Efficiency of Antirinderpest Serum. By Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian, and Frederick Willan Wood, D. V. M., Acting Assistant Chief Veterinarian.

No. 20, The Muscular Changes Brought About by Intermuscular Injection of Calves With the Virus of Contagious Pleuropneumonia. By William Hutchins Boynton, D. V. M., Pathologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

No. 21, A Study of the Normal Blood of Carabao. By William Hutchins Boynton, D. V. M., Pathologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

No. 24, The Role of Stomoxys Calcitrans in the Transmission of Trypanosoma Evansi, by M. Bruin Mitzmain, M. S., Veterinary Entomologist, under the direction of Archibald R. Ward, B. S. A., D. V. M., Chief Veterinarian.

EMERGENCY MEASURES AGAINST RINDERPEST FOR STOCK OWNERS.

By FREDERICK WILLAN WOOD, *Supervising Veterinarian.*

It is the aim of this article to present to the live-stock owners a few suggestions to enable them to take reasonable care of their animals during an outbreak of rinderpest or during the prevalence of the disease in their immediate locality.

Rinderpest is a contagious disease of great economic importance as it attacks carabaos, cattle, sheep, goats, and deer and has a mortality of from 50 to 100 per cent. It is characterized by the appearance of the following symptoms, namely, loss of appetite, great depression, fever, and may be accompanied by a more or less profuse and sometimes bloody diarrhea.

In the Philippine Islands where rinderpest is known to exist to a greater or less extent a farmer or cattle owner should immediately, when his animals appear sick or indisposed, think of rinderpest, and proceed to take precautions to protect his herd, pending the arrival of some one having an expert knowledge of diseases to tell him whether the disease in his herd is rinderpest or something else.

The following measures are those that should be taken as soon as any sickness appears in the herd:

Separate all the animals (or tie them up individually) in secluded places at a distance of 20 meters apart. These secluded spots should be well drained and maintained as dry as possible, as it is known that rinderpest virus soon loses its vitality, if exposed to sunlight and drying. The owner of these animals should immediately notify his local municipal officials and request that the Bureau of Agriculture in Manila be notified, and the local representative of the Bureau of Agriculture should be called on in person and requested to investigate the sickness at once.

Pending the arrival of a competent diagnostician, no person should be allowed to attend more than one or two animals, and

no other species of animals should be allowed near the cattle or carabaos that are sick or have been exposed to the sickness, especial attention being given to dogs, hogs, chickens, goats, sheep, and deer, as these animals can surely carry rinderpest. In case no expert diagnostician is immediately available, place all sick animals in a corral constructed of the best available material and made impassable for the smaller domestic animals. The apparently well animals should be tied at least 20 meters apart in suitable locations, and later, if taken sick, they should be at once placed in the corral. Should no further cases of sickness occur for a period of twenty days the animals may be allowed to work, but only within the confines of the farm on which they were taken sick. During the period of temporary isolation no person except the authorized attendant should be permitted near the animals and all food and water given the animals should be placed in individual receptacles to avoid possible chances of spreading the disease. All excreta from the animals should be placed in deep holes and there well disinfected or cremated. When only a few attendants can be secured for a large group of animals, detail one person to look after the sick animals and the other attendants should take care of those that are apparently well, insisting, however, that attendants when proceeding from one animal to another shall thoroughly disinfect their feet, clothing and hands.

The corral should be constructed in the following manner:

The outer fence should be from 1½ to 1¾ meters high and made of tightly woven pieces of split bamboo arranged in the form of a square 20 by 20 meters. In this fence there should be placed a gate with a width of 1½ meters, this gate being made to open towards the inside of the corral. Inside the fence there should be constructed an inner corral 10 by 10 meters. The fence for the inner corral need not be made as tight as the outer fence, but should be firm and rigid so that its posts may be utilized for hitching the animals that are to be placed inside. The inner corral should have a roof made from branches of trees, sawali, or cogon grass, so that a certain amount of shade will be available for the animals. The poles that support this roof should be at least 4 meters above the surface of the ground, this precaution being taken to allow for sufficient circulation of air above the animals. In one corner of the outer corral a hole about 2½ meters deep by 1 meter in diameter should be dug and the inner and outer corrals drained into this by a series of shallow surface ditches. This hole is also to be used as a recep-

tacle for excreta and filth that will be found from time to time in the inner corral. In case any animals should die they should not be submitted to post-mortem unless an expert on the diseases of animals is present but should be buried intact in a hole 2 meters deep, 2 meters long, and 1½ meters wide, this hole always to be dug between the inner and outer fences of the corral.

Proper individual mangers for the feeding of the animals should be built in the inner corral. Immediately inside of the outer gate there should be placed a large can or crock in which should be placed a 5 per cent solution of creolin, and the corral attendant should be instructed to see that no people entering the corral should leave it without first thoroughly disinfecting their feet and hands. The corral attendant himself should also be required to change his clothes and to disinfect his hands and feet before leaving the corral. Corrals should always be built out in the open and as far away as possible from streams, public roads and trails.

If any of the animals become convalescent, their food should consist of the choicest green grass that is available together with corn meal and palay bran.

If rinderpest exists in the vicinity, but not on your farm, do not allow your animals to do any hauling on the public roads nor pasture or mingle with the neighboring animals. The construction of a fence around the farm is of great value, as fencing is one of the most successful measures that can be used to protect your own herd and those of your neighbors. If new animals are to be introduced from time to time into your herd always quarantine them for a period of twenty to thirty days before allowing them to mix with those that you already own.

In regard to disinfection for the food boxes, yards, corrals and attendants, such materials as creolin, carbolic acid, or whitewash should be used. If creolin is used, it should be prepared as an emulsion with water containing 1 per cent of pure creolin. Carbolic acid should be prepared in a strength of about 2 per cent, and the whitewash prepared from five pounds of unslaked lime to five gallons of water. To this whitewash 3 per cent of crude carbolic acid may be added to increase its disinfecting strength. Lime is suggested owing to its relative cheapness in the Philippines.

By reason of the fact that rinderpest spreads by animals coming into immediate contact with other animals suffering from this disease, any measures that can be taken to avoid the mixing of animals will ensure a greater protection to the various livestock interests of these Islands.

COLLECTED NOTES ON THE INSECT TRANSMISSION OF SURRA IN CARABAOS.

By M. BRUIN MITZMAIN, *Veterinary Entomologist.*

I. THE DISPERSAL OF CARABAO LICE AND THEIR ROLE IN THE TRANSMISSION OF TRYPANOSOMA EVANSI.

Many workers have succeeded in transmitting *Tr. lewisi*, the trypanosome of rats, by the agent of lice, but I have not discovered in the literature any mention of a successful experiment in the transmission of the pathogenic trypanosome, *Tr. evansi*, through the medium of sucking lice.

In the investigation under discussion the host in question is a species of Indian buffalo (*Bubalus bubalis*) commonly regarded as the native carabao of the Philippine Islands. The experiment was undertaken to determine if lice from carabaos infected with surra could transmit the disease to healthy animals.

For the purpose of this test four carabaos were available. Two of these, numbers 7 and 8, had been under observation prior to the experiment for three months in screened stalls; the other two carabaos, numbers 16 and 17, were kept for six weeks in a separate shed, but not screened. Freedom from infection was ascertained by daily microscopic blood examination, taking temperature twice daily, and inoculation of two guinea pigs from the blood of each of the four carabaos. At the end of six weeks, when neither carabaos nor guinea pigs showed trypanosomes in their blood, the hosts were accepted as suitable for the purpose in view.

On December 12, 1910, one thousand lice (*Haematopinus bituberculatus*, Nitzsh) were collected from a carabao whose blood was heavily infected with trypanosomes. The lice were placed with some filter paper in five large flasks, each containing 200 lice. One lot of 200 was set aside to serve as a control; the majority of these lived for two days, but none survived after three days. Two hours after the removal of the lice from their

infected host, the first lot of 200 was placed with great care among the hairs on the body of carabao No. 8. Ten hours later another lot of 200 lice was placed in the same manner on carabao No. 7. Twenty-four hours after their removal from the infected host the contents of another flask was placed on carabao No. 16, and the next day carabao No. 17 received the last lot of 200 lice. The carabaos were segregated in fly-screned stalls, where their temperatures were noted twice daily, and their blood examined daily after the third day of the experiment.

The condition of the four carabaos remained normal until January 3, 1911, twenty-two days after the lice were introduced, when the temperature of carabao No. 8 registered 40.3 C. The blood of this carabao was carefully examined in fresh condition and in stained preparations, when one trypanosome per 50 field ($\frac{1}{12}$ obj.) was found. A guinea pig (Al) was inoculated with 3 cubic centimeters of blood from the ear of this carabao and daily blood examinations were made.

Six days later, January 9, the temperature of carabao No. 8, which had remained normal since the last rise, now registered 40.2 C. The following morning, January 10, a native horse and two guinea pigs were inoculated with blood from carabao No. 8.

After eight days' incubation trypanosomes were found in the inoculated horse. None of the test guinea pigs, however, showed organisms in their blood at this time.

The blood of guinea pig (Al) which was examined daily, did not prove positive until twenty-one days after inoculation. The other two animals inoculated at the same time as the horse, showed trypanosomes typical of surra in ten and twelve days, respectively, after inoculation with blood of carabao No. 8.

The other three carabaos, after one month, showed neither rise of temperature nor suspicious organisms in their blood. At this period guinea pigs were inoculated from the blood of the three carabaos, and examined from time to time for a period of three weeks when the experiment was abandoned.

The horse inoculated with blood from carabao No. 8 passed through the stages characteristic of surra, namely, a general emaciated condition accompanied by a ravenous appetite even while in the protracted death struggles; the appearance of oedematous swellings on breast and forelegs, beginning on the seventh day after inoculation and by the time of death, extending gradually along the abdomen. The animal died twenty-five days after inoculation. Its blood remained positive up to the time of death,

when the heart's blood was found to contain, in a hanging drop, typical trypanosomes to the extent of 40 to 50 per field.

The blood of carabao No. 8 was microscopically examined from time to time and exhibited a moderate degree of infection. The animal was alive and positive for surra on March 31, 1911, when the experiment was discontinued.

It is not to be interpreted that the parasites under discussion are regarded as a practical means of dissemination for surra, and to what extent carabao lice are a factor in the spread of the disease I am not now prepared to state. It is probable that the rôle is not an important one as the insect dies in three days or less when removed from the host. What bearing would this have in the case of an animal dying of the disease which is not common and its parasites migrating to a new host? It would be necessary for the insect to find a new host and begin its attacks within a few hours after the death of the diseased animal. I have noted in two instances of the death of a carabao, that the parasites did not change their positions on the body of the animal until the latter became quite cold, and an hour after death a large number of lice were collected from the cadaver.

One may observe that the presence of carabao lice is largely correlated with the quantity of hair on the animal. In old animals the parasites are relatively scarce since the hair is shed to a large extent and lice do not have the advantage of clinging to these natural supports or employing them as a means of fastening eggs to the body of the host. There are fewer lice on carabaos which are bathed frequently or have ready access to wallows. I believe, especially where a large number of these animals are quartered, that parasites are interchanged quite freely. An example was afforded in the stock of the Bureau of Agriculture at Alabang where a number of carabaos and cattle were confined, in quarantine, in one enclosure in such a manner as to occasionally come in contact with one another.

When these animals were examined nine of the carabaos and three of the cattle were found to harbor trypanosomes. The three cattle were Indo-Chinese bullocks which, when closely inspected, proved to be infested with lice indistinguishable from those found in large numbers on the carabao. It may be noted here that two of the infected carabaos died, and, at autopsy, presented characteristic lesions of surra.

In the case of the three Indo-Chinese bullocks it is not definitely known whether or not the infection was transmitted from the carabao through the transfer of the lice which were found feed-

ing on the cattle. Experiments to cover the point involved are now in progress.

It is deemed desirable to note the bearing of the presence of the organisms found in the body of the carabao louse. The literature on the subject indicates that the surra trypanosome has not been found in this insect. In the Report of the Philippine Commission 1903, part 2, page 452, Musgrave and Clegg, who worked with the same parasites, state in this connection that they have repeatedly performed experiments on various animals which yielded negative results, and were not able to find trypanosomes in carabao lice caught on the bodies of infected animals.

In this regard, although the writer has not succeeded in making satisfactory sections of the parasite, thousands of lice from carabaos whose blood showed trypanosomes in recent examinations, were emulsified with salt solution and observations made of hanging drop preparations. There have been found repeatedly a rather large flagellate and a round form such as has been described for a latent type of *Tr. evansi*.

Whether or not these organisms are developmental forms of the trypanosomes of surra I have not been able to decide. When inoculated into two guinea pigs the emulsion of lice failed to reproduce the disease. In this instance the infected carabao, at the time the lice were collected, was negative for trypanosomes.

In this connection, it is interesting to note that the carabao lice from an infected animal, when placed upon the bodies of two monkeys, did not transmit the disease. The monkeys were immobilized from one to two days at the outset of the experiment and some of the transferred parasites were observed to attack the strange hosts.

In the matter of the dissemination of these parasites an interesting point was presented to the notice of the writer and of sufficient importance to relate. The *Lyperosia* sp. fly, found commonly throughout the Islands, is responsible for the dispersal in nature of large numbers of these carabao lice. The first instance of this kind was noted on February 2, 1912, when a few of these flies from carabaos were collected in determining their seasonal prevalence. Attached to the leg of one of the flies was a young carabao louse. It was fastened by its claws to the fly's tibia, and its new host struggled violently to rid itself of the tenacious burden. In this manner the louse was forced to reattach itself to a less disputed perch, whence it grasped the tarsus and remained there until the death of the fly two days later.

After the first louse was observed in this unusual position more careful and systematic examinations on the body of the flies were made.

The result was that lice were found to be associated with Lyperosia flies on an average of one to three. In a collection of eighteen hundred flies obtained in five days six hundred and twenty lice were counted. Not more than two lice were seen on an individual fly. This average of one louse to three flies prevailed for six weeks, until the middle of March, when the Lyperosia flies gradually disappeared and stable-flies, *Stomoxys calcitrans* Linn, predominated in vast numbers. The louse was never found attached to the latter fly or indeed to any other species but the *Lyperosia* sp.

The parasite in question was undoubtedly the larval form of the carabao louse *H. bituberculatus.* No other species of louse was collected from carabao on which the infested flies were found.

Except to increase the number of possible carriers from the infected carabao it is thought that the lice dissemination by this method does not figure directly in disease transmission. Not one of the lice thus transported was found supplied with mammalian blood. It is suggested that attachment is made either by an error on the part of the louse mistaking the tibia of the leg of the fly for the hair of its host, or transportation is required at this stage of the pediculid's development. An analogy to this is found in the hypopial stage of the Tyrogliphid mites wherein an attachment is found to an insect for the purpose of migration to a more suitable breeding place.

BRIEF SUMMARY.

1. The carabao louse (*Haematopinus bituberculatus* Nitzch.) is shown to be an agent in the transmission of surra from infected to healthy carabaos.

2. The parasites failed to transmit the infection in periods of 48 hours, 24 hours, and 12 hours after removal from the infected host; but proved infectious when applied to a healthy carabao two hours after feeding on the infected host.

3. No evidence is obtained to show that the transmission is cyclic, but it is more probably purely mechanical.

4. Lice removed from infected carabao failed to reproduce the disease in guinea pigs and monkeys.

5. A species of Lyperosia is found in this locality to be a means of dispersal for the carabao louse.

II. AN EXPERIMENT TO DEMONSTRATE PERIODS OF NONINFECTIVITY IN CARABAOS AFFECTED WITH SURRA.

An investigation was made to determine whether the infectivity of a surra carabao is periodic, i. e., if the absence of the organism from the peripheral circulation of a surra carabao can be assumed definitely as an indication of a period of noninfectivity.

It was noticed that, when an emulsion of flies (150 *Lyperosia* sp.) which had bitten a surra carabao on a day when the disease animal was negative by blood examination, was injected into a horse and two guinea pigs there was no reaction, and at another time a lot of flies were collected from the same infected carabao during a positive period, lasting three days, when the animal injected with the fly emulsion responded with a positive reaction for surra.

There is no doubt that had blood been used in both instances in substitution for the fly emulsion the results would have been essentially unaltered. In other words, the injection of flies made immediately after feeding on an infected carabao represents, and is analogous to, a direct inoculation of blood.

In this paper I do not attempt to explain the disappearance of the trypanosomes from the peripheral circulation. It is necessary only to mention that the disappearance of the organisms from the blood of the infected carabao is coincidental with the absence of the organisms from the body of the parasitic fly found feeding at this stage.

Moreover, it is not to be expected that the specific organism will be found in the suspected agent of transmission when there is a marked protracted period of absence of the trypanosome from the blood of the infected host. It would indeed be essential that there exist a decided cycle of development of the surra trypanosome in the body of the fly. Especially applicable would this become in such cases where our records show in four surra infected carabao negative periods of more than sixty consecutive days.

This phenomenon doubtless in a large measure accounts for the negative results of experiments in attempting to transfer at certain periods the infection of surra from diseased to healthy animals by means of biting flies parasitic to both hosts.

The following table serves to illustrate the results obtained from inoculating susceptible animals with blood of carabaos suffering with surra. The condition of the blood found, when subjected to microscopic examination, is noted in various stages previous to time of withdrawal.

TABLE I.—*Periods of noninfectivity in surra carabaos.*

Infected host employed.	Condition of blood previous to time of withdrawal. Negative for—	Positive for—	Animal inoculated guinea pig control.	Date of inoculation.	Results.
	Days.	*Days.*			
Carabao 3024 (Indo-Chinese).	2	------	American horse 24	Jan. 24, 1911	Negative.
			Guinea pig A-13	do	Do.
Do	26	------	American mule 58	Aug. 18, 1911	Do.
			Guinea pig F-9	do	Do.
Do	10	------	American mule 58	Sept. 4, 1911	Do.
			Guinea pig F-12	do	Do.
Do	------	2	Guinea pig G-12	Oct. 5, 1911	Positive on fourteenth day. Dead January 22, 1912.
Carabao 2647 (native).	8	------	American mule 58	Sept. 18, 1911	Negative.
			Guinea pig G-4	do	Do.
Do	------	2	American mule 58	Oct. 16, 1911	Positive on sixth day. Dead November 21, 1911.
			Guinea pig A 1-20	do	Positive on eighth day. Dead January 10, 1912.
			Guinea pig A 1-21	do	Positive on twelfth day. Dead February 14, 1912.
Carabao 2640 (native).	3	------	American horse 35	Jan. 21, 1911	Negative.
			Guinea pig B-19	do	Do.
Do	------	1	Native horse 12	Feb. 19, 1911	Positive on eighth day. Dead March 23, 1911.
			Guinea pig A-5	do	Positive on tenth day. Dead March 28, 1911.
Carabao 2645 (native).	------	1	Guinea pig G-8	Sept. 20, 1911	Positive on twelfth day. Dead January 14, 1912.
Do	26	------	Guinea pig A 1-21	Oct. 16, 1911	Negative.
			Guinea pig A 1-23	do	Do.

The practical significance of this investigation is indicated as follows:

1. During the negative stage of the disease the carabao is not a source of danger as an active focus for fly dissemination.

2. It does not become imperative to verify microscopical findings (when carefully performed) by animal inoculation in suspected cases of surra in carabaos; it is not convincing nor significant during negative periods.

3. When the trypanosome is not found during protracted stages upon microscopical examination it should not be assumed that the carabao is free from infection.

III. AN ENTOMOLOGICAL STUDY OF A SURRA OUTBREAK AMONG CARABAOS IN THE REGION OF LA CARLOTA, OCCIDENTAL NEGROS.

The following cases representing individual investigations on distinct haciendas in the region of La Carlota present themselves for study. The data gathered are as follows:

HACIENDA NO. 1.

From November 10 to one week following, 8 cases of carabao surra were found, along with 1 infected bullock and two suspected cases of carabao surra. In more or less intimate contact with these infected animals there were present 105 cattle, 115 carabaos, and 6 horses. It is worthy of note from information furnished by the owner that surra in carabaos existed on this hacienda for several years, and that animals, carabaos, cattle and horses were permitted to pasture in common freely. The 6 horses, although stabled apart, were in more or less daily contact with the carabaos, 1 of them a mare three months in foal had lived on this, its birth place, for ten years; 2 lived on the hacienda for three years; 2 for three months, and 1 for three weeks. All of the 6 horses had been carefully tested for surra and all were free from the disease.

More than 80 per cent of the flies found on animals from this hacienda were common parasites on all three species of mammals present; they were the common *Lyperosia* flies.

HACIENDA NO. 2 (OBSERVED NOVEMBER 10, 1911.)

Here were examined 90 cattle and 60 carabaos. No surra was found except in the case of a horse which had been transferred four weeks previously from a neighboring hacienda. This surra horse had been left on the hacienda under discussion for two weeks, exposed to flies in a shed within 20 feet of the corral occupied by the 150 head of cattle and carabaos. Not a single specimen of *Stomoxys* was collected from the carabaos. The flies for the most part were *Lyperosia* sp.

HACIENDA NO. 3 (OBSERVED NOVEMBER 10, 1911).

An Indo-Chinese bull was found here within one mile of the La Carlota experiment station with a virulent infection of surra. More than 50 carabaos occupied the same pasture but were surra free. The infected animal was apparently in fair condition. Only a very few *Stomoxys* were found and the *Lyperosia*

flies hovered in a dense swarm close to the bull; they numbered approximately 1,000 to 1,500. It was also of interest to note that carabao lice were collected from this animal.

HACIENDA NO. 4 (OBSERVED NOVEMBER 11, 1911).

On this hacienda 90 carabaos were examined, 4 of which were positive for surra and 8 showed clinical features of the disease. The contacts here were 2 mares, with foal, kept stabled some distance from the pasture. These dropped colts which, at the time of examination, were three and six months old; the latter were surra free. The sire, stud of the 2 mares, was found to be infected with surra. At the time it was identified the animal had been removed a mile away to a neighboring hacienda where there was no surra.

The question is, Did the horse contract surra from the infected carabao? It might have done so, but another source of infection was present, for the horse was used as a carriage horse visiting other haciendas and towns. Did it contract surra en route?

HACIENDA NO. 5 (OBSERVED NOVEMBER 12, 1911).

Twenty-three cattle and 53 carabaos were examined on this hacienda. No case of surra was detected in two weekly examinations. Here was noted an almost entire absence of carabao lice. All of the carabaos were covered with slime from their wallows. The owner asserted that he kept them as much as possible in mud wallows in order to kill the lice. Only one carabao showed lice and but few of them.

Flies.—No *Tabanidæ* were seen. *Lyperosia* flies and *Stomoxys* were present, about 1 per cent only of the latter.

HACIENDA NO. 6 (OBSERVED NOVEMBER 13, 1911).

One hundred and three carabaos were examined. Eight cases of carabao surra were found one week previously, and at the present examination 6 cases and about 12 suspects, i. e., showing clinical features, but no trypanosomes. Here were noted a greater number of lice than those from the previous case in which no surra was found. *Lyperosia* flies here predominated. Few *Stomoxys* were present.

HACIENDA NO. 7 (OBSERVED NOVEMBER 17, 1911).

On this hacienda there was located a herd of carabaos showing, by microscopical examination, an infection of 8 per cent. The following flies were collected from five carabaos which were surra

positive on the day of inspection: *Lyperosia* flies, 341 specimens; of *Stomoxys* 7; of *Muscid* (nonbiting) 7. A vast predominance of *Lyperosia* was observable in general.

DISTRIBUTION IN GENERAL OF FLIES ON SURRA-INFECTED HACIENDAS.

Tabanidæ.—During two weeks of field observations but seven specimens of the horse flies were taken in this district. Three of these were collected while they were feeding on cattle and four males were collected on trees or sheds near the cattle.

Stomoxys.—Few *Stomoxys* were found on any host. In order of distribution in relation to host they are: Horse, cattle, carabaos.

Lyperosia.—As noted in all the cases where surra was found or suspected this fly was found remarkably predominant. On carabaos especially, they swarmed above and below on the abdomen of the animal.

The fly distribution as observed in the various haciendas is shown in Table II, below:

TABLE II.—*Fly distribution.—Percentage according to host.*

	Lyperosia.	Stomoxys.	Nonbiting Muscid.	Tabanids.
Cattle	70	10	20	3
Carabaos	95	3	2	----------
Horses	25	70	5	----------

MEANS OF TRANSPORTATION OF SURRA IN LA CARLOTA.

An animal, whether surra infected or healthy, carries with it, when traveling, as many as several hundred flies from a focus of infection. These flies remain on the animals during transportation serving as carriers from one town or one hacienda to another. The flies are observed to remain with the animal more or less persistently for a distance of several kilometers. These flies are switched off and seek new hosts while the animal is resting at its destination. The parasites in question are, in the main, species of *Lyperosia* and *Stomoxys.*

DISCUSSION OF FIELD OBSERVATIONS.

With the limited data at hand only generalizations can be pertinent. It is realized that, for a study of surra conditions to be of economical value, a period exhaustive of meteorological and other phases must be devoted to it. To be sure, observations must be made during wet season and dry, and geographical

variations considered. The present study was of only two weeks' duration, pursued for the purpose of making certain laboratory findings more comprehensive. In this matter, for instance, there is substantiated from observations in this region, that carabao lice in unusual numbers, with due consideraion to other insects, influence the incidence of surra. Also, carabao lice and *Lyperosia* flies are intimately related in numbers.

The significance of this is indicated in results from experiments in which carabao lice transmit surra, and that *Lyperosia* flies are a means of dispersal of carabao lice.

It now devolves upon us to demonstrate under laboratory conditions the rôle of the *Lyperosia* sp. flies in surra transmission.

IV. THE RELATION OF LYPEROSIA sp. FLIES TO SURRA IN CARABAOS.

The following is contributed as an experimental application of observations tending to show a relation between the presence of *Lyperosia* flies and surra in carabaos. An experiment performed under laboratory conditions is herewith cited.

A fly-proof cage with a substantial fly-proof entrance, 7.3 meters by 9.1 meters, with a height of 4.5 meters graduated to 3.6 meters was so partitioned that two surra-infected carabaos and a healthy carabao could occupy adjoining stalls without bodily contact and still be exposed to the bites of flies placed in the enclosure. Two surra carabaos, Nos. 3228 and 3252, which were in advance stages of the disease, were placed on one side of the coarse-screen partition and the healthy carabao, No. 16, was selected to be exposed.

The parasites used were *Lyperosia* flies taken in the open shed from healthy work carabaos. These were transferred twice daily to the caged animals, and were placed promiscuously in the screened enclosure. The parasites attached themselves to the new hosts quite readily. In all, over 5,000 flies were employed during the course of the experiment lasting about one month, from January 12 to February 13, 1912. The healthy animal, carabao No. 16, was not removed until two weeks later, February 28, when all of the flies had disappeared.

As shown in Table III following, blood examinations of the three carabaos were made daily. Carabao No. 3228 was positive for trypanosomes upon eleven days and carabao No. 3252 was positive for an equal number of days, and, between the two carabaos, the disease was present in a fly-communicable form during eighteen days of the experiment.

TABLE III.—*Result of exposing surra carabaos and a healthy carabao to Lyperosia flies.*

Date.	Number of flies placed in the inclosure.		Trypanosome examination in carabao—		Result of fly exposure in carabao No. 16.
	A. M.	P. M.	No. 3228.	No. 3252.	
January 12, 1912	11		Positive	Positive	Negative.
January 13, 1912	170	110	do	do	Do.
January 15, 1912	122	115	do	Negative	Do.
January 16, 1912	183	87	do	do	Do.
January 17, 1912	153	106	Negative	Positive	Do.
January 19, 1912	70		Positive	do	Do.
January 22, 1912	75		Negative	do	Do.
January 23, 1912	88		do	do	Do.
January 24, 1912		20	Positive	do	Do.
January 25, 1912	40	48	Negative	do	Do.
January 26, 1912	103	230	Positive	Negative	Do.
January 27, 1912		112	Negative	do	Do.
January 28, 1912	75	40	do	do	Do.
January 29, 1912	290		do	do	Do.
January 30, 1912		120	do	do	Do.
January 31, 1912	102		Positive	do	Do.
February 2, 1912		93	Negative	do	Do.
February 3, 1912	127	445	do	Positive	Do.
February 4, 1912		339	do	do	Do.
February 5, 1912	593		do	do	Do.
February 6, 1912	432	114	do	Negative	Do.
February 7, 1912	131	262	Positive	do	Do.
February 8, 1912	138	70	do	do	Do.
February 13, 1912	131		do	do	Do.

Carabao No. 16 showed no evidence of the disease either by temperature reaction or blood inoculation when released February 28. Subsequent observation of this animal during its two months' quarantine convinced the observer that the experiment under discussion terminated negatively. A single experiment, however, does not warrant a conclusion that this species of flies is not a factor in the dissemination of surra.

Other similar experiments are in operation at the present time.

ACKNOWLEDGMENT.

I am indebted to Dr. Charles S. Banks, entomologist for the Bureau of Science, for the determination of the species of the parasites used in the experiments, recorded in the paper entitled "The Dispersal of Carabao Lice and their Rôle in the Transmission of Trypanosoma Evansi."

From the veterinary research laboratory, Bureau of Agriculture, Alabang, Rizal, P. I.

CURRENT NOTES[1]—DECEMBER.

PROGRESS OF PORTO RICO.

The annual report of the Agricultural experiment station of Porto Rico has just been issued and contains many items of interest to the residents in the Philippines considering the situation of both these countries.

The trade of Porto Rico has increased from ₱33,200,000 in 1900 to ₱157,400,000 in 1911, of which ₱80,000,000 are exports, all agricultural materials, raw or manufactured. Sugar is the leading export now. Tobacco and cigars to the value of ₱14,000,000 were exported—other manufactured products were preserved fruits, straw hats, and distilled spirits. The advance of agri-horticultural science is shown by the importation of artificial fertilizers to the value of ₱2,000,000. Steam plows are largely utilized on the large sugar estates, and the cable plow is there favored in preference to the motor truck. Coffee in Porto Rico is a crop of considerable importance but pineapples and citrus fruits are now encroaching upon the coffee.

The growth of the fruit industry in Porto Rico during the last decade is remarkable. From nothing, the fruit export has during this time grown to ₱3,600,000 during the past fiscal year, yet the fruit orchards are just coming into bearing. Very superior pomelos and oranges are produced and aside from the fresh fruit shipped to the United States several pineapple canneries are in operation there. (*P. J. W.*)

TRANSVAAL AGRICULTURE.

Is it any wonder that a country which produces almost 38 per cent of the world's gold output, i. e., nearly ₱1,000,000 worth *per day*, should have plenty of money (from the internal-revenue tax on mine products) for agricultural experiments? In that country, possessing but few districts which could be called even medium-grade farming lands, with its rocky pastures filled with poisonous weeds and grasses, and with only very limited areas

[1] Original notes prepared by various members of the Bureau of Agriculture.

adapted to fruit raising, we find the world's best veterinary research laboratory, as well as experiment farms and breeding stations which compare favorably with those of either Europe or America. Where the veterinarians of most countries would be obliged to confine their experiments to a few head of animals for each phase of the work, the little-known but best, at least so far as equipment goes, veterinary station at Onderstepoort, near Pretoria, can well afford to take a *small herd* instead of an individual.

Considering the perspective, therefore, it is believed the world must see in the comparatively insignificant sums of money spent on agriculture in the Philippines a vastly better opportunity for success; and it will be an interesting point to note whether that other formerly rinderpest-ridden country, which appears to be even now seriously afflicted with animal diseases, can show in the long run, better results, scientifical and practical, than will be acquired from the expenditure of the meager amount allotted for agricultural investigations in the Philippines. (*O. W. B.*)

GOVERNMENT HELPS FARMERS.

In no other country in the world does the government lend aid to its farmers as does Denmark. The greatest energy is expended in securing the largest and most economical production of butter, bacon, and eggs. The most significant thing is that the greatest efforts are made to help the small farmer, with the result that the country is now almost wholly made up of small farms. One of the principal sources of aid is through furnishing farmers with cheap money. The government controls a series of banks. A laborer who has worked on a farm five years, and who has a character so good that two reputable farmers will certify to it, may obtain from one of these banks a loan corresponding to about ₱3,164 in Philippine currency. With this he may purchase a farm of from 1½ to 5 hectares. The amount loaned by the bank covers probably nine-tenths of the value of the farm. Experts of the government visit every farm in Denmark every eighteen days and advise with the farmers as to the best methods of handling their business. While dairying is the principal industry, swine and poultry production are highly developed. The area of Denmark is a little less than 4,000,000 hectares, as compared with 10,600,000 hectares in Luzon, and much of the land is by no means good, yet a population of 2,200,000 is supported, and the annual exports of butter, bacon, and eggs amount to ₱300,000,000.

While all of this is not applicable to the Philippines, a similar policy at least could be pursued and with great profit to all concerned. Dairying of course is not to be recommended, but swine and poultry production certainly should thrive here. There are plenty of good crops that will grow here which are adapted for feeding hogs and chickens, and both lines could be followed with profit. Horticulture, sugar cane, and rice might readily take the place of dairying. The big thought to consider is that of furnishing help to the small farmer. The large operators in any line have little need of government aid. The prosperity of the small farmer in any agricultural country is what really shows the economic condition of the country.

The policy should be to enable trustworthy men to secure small farms, and farms should mean as in Denmark, a plant ready for immediate production, including buildings, implements, and live stock, just as a factory includes all the necessary machinery for turning out a finished product. It is very doubtful if the Government as a whole could undertake any single line of work that would ultimately mean more to the Islands than this. Of course it could not be expected that the policy would show, at least not for quite a number of years, the same splendid results as are common in Denmark. The principle is absolutely sound, however, and could be applied to the Philippines. The present Department of Public Instruction, through the Bureau of Agriculture, and perhaps also the Bureau of Education, could furnish the inspectors, or, more accurately speaking, the farm advisers to aid in the upbuilding of what would be, under such a policy, the new agriculture of the Philippine Islands. (*H. T. N.*)

KAPOK IN VENEZUELA.

From the Daily Consular and Trade Reports we learn that a syndicate will soon be established at San Carlos, in the State of Zamora, Venezuela, with the object of producing wholesale quantities of first-class kapok. It is said that the plantation will be all virgin land and that one hundred laborers are now at work in the clearings. It is questionable, however, whether it is wise to put all the eggs in one basket and plant nothing but kapok on the entire estate. (*O. W. B.*)

GOVERNMENT AID TO HORTICULTURISTS IN AUSTRALIA.

A new departure in fostering an infant industry is the proposal of the governments of New South Wales and Victoria in Australia to establish vegetable and fruit-preserving factories in regions

newly opened for colonization. These factories will be operated by the departments of agriculture of their respective states, the produce handled at a moderate rate, and if the settlers desire, the factories may later be acquired and operated under coöperative management.

The colonists will also be aided by the government in the production and specialization of the fruits that are best adapted to the regions under consideration and which make a superior canned product. This Australian enterprise might well serve as a good object lesson to the Philippines. (*P. J. W.*)

HORTICULTURAL HEBETUDES.

It is generally supposed that the modern horticulturist is constantly surrounded by a mass of cold facts and monotonous methods, with no jolly jokes and never a hoax nor bit of mirthful nonsense to relieve the day's work; but there are cases which are worth telling if only to prove the fact that even in a supposedly commonplace science there are a few relieving diversions.

One of the most overworked hoaxes concerning plant work is that of the artificial feeding of squashes, melons, papayas, etc., by means of nutritive liquids; in this matter the horticulturist is from time to time instructed in the details of the method of procedure, i. e., as to the proper amount of sugar to put in the bottle which is attached by means of a (real red) rubber tube to the interior of the stem of the plant to be forced. Sometimes additional directions are suggested in the line of adding certain chemicals or nostrums to the soil about the roots or even to the hollow interior of the plant stem. But the last word *after* the laugh is that in future times the horticulturists may be able to successfully use some of these preposterous ideas.

Again, the horticulturist is sometimes cheered, in the midst of dreary routine of problems under consideration, by requests for information concerning tapioca seed, sweet potato seed, vanilla beans, cocoa beans, etc.; or his correspondent wishes to know, perhaps, how far apart mango hills should be spaced—and this is no worse a question than "what space should ketchup hills be allowed?" (for mangos are pickled young melons) ; but how can he convince the prospective vanilla planter that a "bean" is a pod, or rather fruit, containing scores of thousands of seeds? The wonder is that no requests, except occasional misspelled ones from students, ever come for flour seeds—for if there are

tapioca seeds there must, of course, be meal, flour, and, presumably, macaroni seeds.

Sometimes, too, the horticulturist is severely taken to task for his ignorance of certain things which to the informer are supposed to be perfectly good facts. For instance, it is amazing, of course, that he does not know that the sex of male, or non-fruiting, papaya plants can be simply, cheaply, and effectively changed by the attachment of anything distinctively feminine, such as a miniature petticoat, to the trunk of the otherwise useless male plant. It is also quite doleful to think that one who rummages through province after province for new varieties of orange, lime and other fruits should overlook the "green orange of Manila" which is said to be at first yellow, and then finally, when ripe, a lovely mental green (subjectively speaking, of course)—and when the horticulturist protests against this reversion of colors, he may be told to jot down the fact that the "green Manila" orange does not have to conform to the regulations of the other members of the citrus family.

Ordinary freak ideas, such as the seeds of one fruit producing trees of another sort, are, of course, common and always will be. The average reader who runs is eagerly credulous of the tales of startling "crosses;" hybrids, for example, between apples and strawberries, as "true members of the same botanical family," excite the imagination of even the dullest, while stories of dual-purpose potato-tomato plants are getting stale—and almost true.

But what a pity it is that after all the wonderful variety of superstitions about the moon's influence upon the sprouting of seeds, growth of plants, and yield of fields, there is not some small grain of truth in the cloud of hebetudinous delusions surrounding this interesting subject! Many intelligent people are always willing to defend their beliefs in the said moon management of mundane plants; and even lumber dealers have been known to quarrel over the same matter, forgetting that it is really a question of *season* and has nothing to do with any quarter, fore or aft, of our innocent satellite. (*O. W. B.*)

NOTES ON VANILLA.

According to the "Chemist and Druggist," the world's production of vanilla beans for 1911 was 590 tons; of this large total 195 tons were grown in Tahiti; 145 tons in Mexico, the home of the vanilla plant; while the Comoro Islands produced 70 tons. We have heard it argued that vanilla can not be grown in the Philippines because of the inability of the native to handle

the crop and cure it. Can it be that the American and Filipino combined can not accomplish what the French and Polynesians, now the leading vanilla exporters of the world, have done in little Tahiti?

The Bureau of Agriculture in attempting to establish vanilla culture in the Philippines has successfully introduced nearly 30 lots (comprising some six species) of vanilla during the past nine months, all of which are doing well. In this connection it is interesting to note that some two or three species of vanilla are indigenous to the Philippines, two having been found recently in Mindanao by the writer; whether or not these species are of commercial value is yet unknown. They are far superior in vigor to the commercial vanilla, and will be forced into fruiting at as early a date as practible in order to determine their value. Even if they should prove disappointing in this respect they may be of value for hybridizing with *Vanilla planifolia* with the object of infusing more vigor and hardiness into this species. (*P. J. W.*)

COCONUT PESTS.

While we may dolefully consider that the Philippine coconut has a discouragingly large number of pests which reduce the profits of the planter, we should always "count our blessings." To be sure, we have the ubiquitous and very injurious "uang," and the still more insiduous red beetle, not to mention dozens of minor insect pests; the viciously destructive wild pigs and the wary deer which make planting in some districts practically impossible except inside of extra strong and tight woven-wire fences; crows, monkeys, rats, and even crabs, which take their heavy toll in most districts; and some seventeen distinct species of fruit bats, some of which do not confine their attention to bananas and soft-skinned fruits but actually damage the very young coconuts in their flower-clusters: but we should be sincerely thankful that we are thus far never in any province pestered with the more destructive denizens of the Bornean jungles which render the coconut planter's life less happy than it might be in our neighboring countries of that island.

For instance, the Mindanao planters never need to get up in the night to drive a herd of 4-meter-high elephants out of their young groves, nor to strive in vain to build fences against the amazingly strong and exasperatingly persistent tapirs; the heart buds of their coconuts are never eaten out over night by wandering families of bruangs, or Malayan bears; and while

we have plenty of monkeys, they are small and harmless compared with the ourang-outang.

In this connection, however, we should remember that the Bornean planters are nevertheless very liable to surpass the Philippine planters in the way of estate management and careful attention to the plants themselves—for does not adversity have its uses? (*O. W. B.*)

THE INCREASING DEMAND FOR CACAO.

The rapidly increasing demand for cacao is amply illustrated in the world's consumption of cacao which has increased from 122,526 tons in 1903 to 232,200 tons in 1911. In this connection it is interesting to know that Mexico, where the Europeans first found this "drink of the gods," as it was styled by Linné, has practically ceased to export cacao. Why does not the Philippines wake up to her opportunities as a cacao producer and exporter? (*P. J. W.*)

SYNTHETIC RUBBER.

For many years the rubber planter has dreaded and dreamed of the terrible *bête noir* of artificial rubber and while there is no immediate need for the practical planter to fear that his work is in vain it is certain that a large stock company to exploit synthetic rubber in Europe has just been floated.

By the same token synthetic rubber may not be very elastic and it may, at the present writing, be rather expensive, but the cold and rather lugubrious fact is that common corn or potato starch can be fermented so that it yields methyl alcohol (which is vulgarly known as fusel oil) and acetone, and from this first process isoprene can be obtained, which in turn, after two or three other chemical maneuvers, produces dimethylcyclooktadiene—or whatever the chemists now prefer to call it. In other words, starting with common starch at some ₱0.10 per kilo and a moderate amount of salt, lime and, of course, coal artificial rubber can be and is actually produced. (*O. W. B.*)

A NEW LIVE-STOCK INDUSTRY FOR THE PHILIPPINES.

Considerable attention has been paid during the last few years to the proposed introduction of hippopotami from Africa to the swamp-lands of the southern United States for the production of meat. During the fiscal year ending June, 1911, meat and meat products were imported into the Archipelago to the value of ₱3,103,084, exclusive of live animals—a not inconsiderable

amount, considering the total trade of the Philippines. The hippo furnishes an excellent class of meat and notwithstanding its size—2 to 4 tons live weight—it is quite harmless and of a peaceable disposition. The "lake region" of the Agusan Valley, Mindanao, would seem to be eminently well adapted for the rearing of hippos, and the writer is of the opinion that if this entire region were made into a large reservation and stocked with these animals, it could be more profitably utilized in this than in any other way, thus supplying a large quantity of excellent meat in place of that which is now imported. (*P. J. W.*)

BOOK REVIEW.

THE WORLD'S CANE-SUGAR INDUSTRY, PAST AND PRESENT.

By C. M. Conner, *Chief, Division of Agronomy.*

Fresh from the press comes "The World's Cane-Sugar Industry, Past and Present," by H. C. Prinsen Geerligs. This book treats of history of introduction, growth of industry and present outlook for cane sugar in every country in which sugar cane has been or is now grown. It is a very valuable hand-book for the student of the cane-sugar industry.

Native methods of culture and manufacture, as followed in the various countries, are discussed more or less in detail in case they differ materially from standard methods.

Whenever possible, complete statistics are given relative to production and exportation of sugar in the various countries.

Sixteen pages are devoted to sugar production in the Philippine Islands.

This book is published by Norman Rodger, Altrincham (Manchester). The price is 12 shillings.